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Coopers and Lybrand, Washington, DC

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Water

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Report to Congress Industrial Cost Recovery

Volume II — Detailed Methodology, Findings, Alternatives, and Recommendations

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16. ABSTRACT

This document presents the U.S. Environmental Protection Agency's final report to the Congress on its Industrial Cost Recovery Study as directed by the Congress in Section 75 of Public Law 95-217, the Clean Water Act of 1977. This provision of the statute requires EPA to study the "efficiency of, and need for" the repayment by industry of that portion of the EPA grant used for construction of industrial capacity in publicly-owned wastewater treatment systems, and requires EPA to report the results of the study to the Congress by December 31, 1978. The final report consits of seven volumes:

Volume II - Detailed Methodology, Findings, Alternatives, and Recommendations

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II. DETAILED METHODOLOGY

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A variety of analytical techniques were utilized during the ICR study. These techniques included:

- Economic Analysis
- Survey Analysis
- Financial Simulation
- Cost Function Analysis

In the following sections each of these techniques and its method of application is described in detail.

1. Contractual Scope of Work

EPA's Contract 68-01-4801 included a Scope of Work (see Exhibit V-1-1 in Volume III) which required Coopers & Lybrand to "examine--with full public participation--the efficiency of, and need for, the Industrial Cost Recovery provisions of the Federal Water Pollution Control Act." The objective was to be met through work divided into three phases:

- Development of the Study Methodology
- Data Collection
- Data Analysis and Report Preparation

A brief summary of each of these phases is presented below.

a. Development of the Study Methodology

This phase was to consist of the following subtasks:

- Establishment of project protocol
- Preliminary literature survey
- Revalidation of issues, definition of data requirements and methods of analysis

Project protocol activities included orientation meetings with project staff and EPA personnel, establishment of a project file structure, and development of a documentation system for all project communication. Included, also, was the establishment of an advisory group of interested parties.

The literature survey was to encompass pertinent EPA studies, industrial data bases and models, and data within the province of advisory group members.

Following those efforts, the basic issues were to be revalidated, analytical techniques identified, and associated data requirements defined.

b. Data Collection

An information base was to be developed to permit analysis of at least several issues: combined and incremental impact of user charge and ICR costs on five industries and on industries in thirty selected urban and non-urban communities; cost of ICR to industry groups, by geographic location, and in urban and rural areas; ICR as a function of prevailing levels of unemployment; if possible, the incremental cost of collecting ICR over that required for user charges; old versus new cities; and in cities with wastewater treatment facilities funded with PL 92-500 funds versus PL 84-660 funds. The cost of ICR monitoring and enforcement was to be addressed; the benefits to industry from ICR "interest free" loans; ICR cost as a percentage of total expenses to industry; a comparison of industrial sewage costs in publicly owned treatment works (POTW's) versus direct discharge; and the impact of ICR on selected national industrial growth patterns. The level of business closures caused by ICR was to be examined, as was the impact of ICR on inter-industry competition, and the impact of exemptions from ICR on various user classes. Also to be investigated was the impact of ICR on employment, export/import balance, local tax bases, industrial water conservation, small businesses and economies of scale (in wastewater treatment facilities). The question of encouragement of cost-effective solutions to water pollution was to be examined, as were alternative methods of excluding small businesses from ICR, the extent of ICR disparities in adjacent geographic areas, differences between ICR costs related to secondary treatment and advanced waste treatment, alternative methods of achieving ICR parity, and local government impacts of ICR.

The basic vehicle for obtaining the data needed to address these issues was to be a survey that would encompass at least 220 communities and industrial establishments in at least 5 industries. An estimated 50 businesses were to be contacted.

The field survey effort was to consist of the following subtasks:

- design of survey instruments
- development of interview guides
- preparation of survey plan
- orientation of field staff
- pre-test and modification of survey methodology
- conduct survey
- summarize results and data

Coopers & Lybrand was to participate in four public review meetings in Washington.

c. Data Analysis and Report Preparation

Analytical approaches selected during the methodology phase were to be modified as appropriate during the data collection phase. All survey data was to have standard validation tests performed. Appropriate data validation techniques were to be applied to any non-survey data utilized.

Preliminary evaluation could lead to modification of analytical approaches. Ten public meetings were to be held in EPA's ten Regional Office cities, and Coopers & Lybrand was to support and participate in these meetings, and then prepare draft and final reports.

2. Economic Analysis

a. Background

The legislative history of P.L. 95-217 reveals a Congressional concern with the actual and potential impact of ICR on business. These included the impact of ICR on:

- the cost of doing business
- employment
- small business
- businesses subject to seasonal variations
- the achievement of cost effective solutions to water pollution.

Time and funding limitations dictated, however, that the analysis of the impact of ICR on industry be limited to a number of industry groups.

The methodology utilized to select the industry groups for study consisted of:

- Development of Selection Criteria
- Determination of Candidate Industries
- Analysis of Candidate Industries
- Selection

The effort was initiated at a meeting that was convened with the C&L project staff and EPA ICR specialists at both the Regional and the national level. That meeting was utilized to produce selection criteria and an initial candidate industry list.

b. Selection Criteria

A review of the legislative history and the history of the ICR program produced seven criteria of importance. These criteria, their order of importance and an explanation of each is presented below:

1. Labor intensive - with the emphasis of the legislative history on unemployment, the selection of industries that were labor intensive and had a high percentage of total employment was deemed to be of primary importance.

2. Low Operating Margin - as ICR is an added cost of production, industries with a low operating margin (or low value added relative to value of shipments) would magnify the impact of ICR on costs of production.

3. High Flow - as the size of an ICR bill is proportional to flow, water use and wastewater discharged are important determinants of economic impact.

4. Size of Industry - as the national economic impact is of interest, industries that are large from the standpoints of number of establishments, employees and shipment values would be more useful to analyze than small industries.

5. Seasonality - industries that are seasonal are uniquely affected by ICR. In many cases, the annual ICR charge is determined by the maximum flow. Thus, an industry with a limited season experiences a multiplication of the impact of ICR charges.

In addition, the extent of pretreatment and the size of plant were considered to be of interest. While pretreatment reduces ICR costs, it does affect the cost-effectiveness decision. Also, a range of plant sizes, small and large, was deemed important to determine economic impact for a range of plant sizes.

c. Candidate Industries

Based on information submitted to both regional and national offices of EPA, the following industries were submitted as candidates for further analysis:

- Bakeries
- Seafood Canners
- Dairies
- Meat Packers
- Breweries
- Paper and Wood Products
- Textile Manufacturing
- Ferrous Metals
- Nonferrous Metals
- Leather Tanning
- Raw Food Processing

d. Economic Analysis

To provide a consistent basis for analysis, the candidate industries were reviewed and the following Standard Industrial Classification (SIC) Codes were assigned, as shown below:

SIC Code	Description
2051	Bread and Other Bakery Products
2091	Canned and Cured Fish and Seafood
202X	Dairy Products
2011	Meat Packing
2082	Malt Beverages
2621 or	Paper Mills
26XX	Paper and Allied Products
22XX	Textile Mill Products
34XX	Secondary Metal Products
3111	Leather Tanning and Finishing
2033	Canned Fruit and Vegetables

Using the Department of Commerce Census Bureau's Census of Manufacturers (1972 and 1976 annual) as the sole source of information, the table shown in Exhibit II-2-1 (following this page). was prepared. Most of the data shown is from the 1972 census, 1976 data includes:

- Number of establishments
- Value added
- Shipment value
- Number of employees (all)

To support the evaluation, the following measures were developed:

Exhibit II-2-1

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SUMMARY EXHIBIT

SUMMARY EXHIBIT

Code	Description	WATER INTAKE (B Gals.)	WATER INTAKE (% of Total)	WATER INTAKE Per Plant (M Gals.)	WASTE WATER DISCHARGED TO PUBLIC UTILITIES (B Gals.)	WASTE WATER DISCHARGED TO PUBLIC UTILITIES (% of Total)	WASTE WATER DISCHARGED TO PUBLIC UTILITIES Per Establishment (M Gals.)	Seasonality Factor (High Qtr / Low Qtr) Workers	Seasonality Factor (High Qtr / Low Qtr) Man Hours	Number of Establishments	Establishments Less than 20 Workers	Establishments More than 100 Workers	Seasonality Factor (High Qtr / Low Qtr) Workers	Seasonality Factor (High Qtr / Low Qtr) Man Hours	Number of Establishments	Establishments Less than 20 Workers	Establishments More than 100 Workers	Operating Margin (Value Added / Value of Shipment) (%)	All Employees (as % of Total)	Shipment Value (as % of Total for USA)	Shipment Value per Establishment ($000,000)
51	Bread & Other Bakery Products	2.8	<<1	.08	d	-	-	1.01	1.05	3,323	588	188	1.01	1.05	3,323	588	188	56	1	.6	2.9
91	Canned & Cured Fish & Seafood	d	-	-	d	-	-	1.45	1.66	310	55	11	1.45	1.66	310	55	11	30	.07	.1	4.4
2	Dairy Products	45.3	0.3	77.7	1.8	<<1	.39	1.1	1.1	4,590	54	14	1.1	1.1	4,590	54	14	21	.9	2.1	5.8
11	Meat-Packing	64.3	0.5	28	26.0	8.5	10.5	1.03	1.05	2,475	65	12	1.03	1.05	2,475	65	12	13	.8	2.7	13
82	Malt Beverages	61.9	0.4	370.65	4.7	1.5	28.4	1.03	1.11	167	22	57	1.03	1.11	167	22	57	38	.2	.5	36
21	Paper Mills	1,277.9	8.5		40.5	10															
26	Paper & Allied Products	2,415.4	16.1	400	46.5	15.2	7.7	1.03	1.03	6,038	34	29	1.03	1.03	6,038	34	29	43	3.3	4.1	8
	Textile Mill Products	177.7	1.2	24.7	17.2	5.6	77	1.03	1.05	7,201	37	30	1.03	1.05	7,201	37	30	40	4.7	3.1	5
	Secondary Metal Products	107.3	0.7	3.6	11.7	3.8	128	1.06	1.07	29,525	60	10	1.06	1.07	29,525	60	10	50	7.6	5.8	2.3
11	Leather Tanning & Finishing	7.8	<<1	10.7	1.7	<<1	3.28	1.34	1.13	517	57	15	1.34	1.13	517	57	15	34	.1	.1	2.5
33	Canned Fruits & Vegetables	38.4	0.3	37	6.8	2.2	2.12	3.17	2.89	1,038	80	27	3.17	2.89	1,038	80	27	36	.4	.5	6
	All U.S. MANUFACTURING	15,024.3			305.1					312,662					312,662						

d data collected by Census but withheld to avoid disclosing figures for individual companies.

- Seasonality Factor - the ratio of high quarter to lowest quarter (for both number of workers and man-hours) was utilized as a proxy for seasonality. The larger the value for this ratio, the more seasonal an industry would be expected to be.

- Operating Margin - the ratio of value added to value of shipments was utilized to indicate the amount of non-fixed costs involved. A smaller number here would indicate a thinner margin.

e. Selection of Industries

Arranging the data of the exhibit against the criteria produces the following four clear cut choices:

34XX Secondary Metal Products - the largest in number of establishments (29,525), number of employees (7.6% of all manufacturing) and shipment value (5.8% of all manufacturing).

2011 Meat Packing - has the lowest ratio of value added to shipment value (the proxy for operating margin) and, in addition, a substantial wastewater discharger to POTWs (8.5% of total).

2621 or 26XX Paper Products - are the largest from the standpoints of water used (16.1% of total) and wastewater discharged.

2033 Canned Fruits and Vegetables - the only industry displaying extreme seasonality (employment during the peak quarter was three times employment during the slack quarter).

The next industry position was assigned to 202X, dairy Products, for the following combination of reasons:

- Large number of establishments (4,490)
- Second lowest operating margin
- Generally small establishments (54% with less than 20 workers)

At a later point in the project, textile mill products, 22XX, was added as the final industry group. While not first in any single category, textile mill products ranked second in both workers and number of establishments. Of importance to the study, however, was that this industry tended to be located in cities which, either due to location or size, had higher ICR rates than most. All industries selected perform pretreatment to some degree.

f. Summary

The six groups selected and their standard Industrial Classification (SIC) codes are:

SIC Code	Industry Group
2011	Meat Packing
2020	Dairy Products
2600	Paper & Allied Products
3400	Secondary Metal Products
2033	Canned Fruit and Vegetables
22XX	Textile Mill Products

In the aggregate, the six industry groups selected account for the following:

- 19% of all water used by industry
- 37% of all wastewater discharged to public utilities
- 18% of all employees
- 18% of all industry in terms of value of shipments
- 50,867 establishments

In addition, the list includes:

- One highly seasonal industry

- One industry of predominantly small establishments
- One industry of predominantly large establishments

As the project proceeded, some minor changes were made in the identification of the target industry groups. In some cases the change consisted of adding an SIC digit to reduce the number of individual candidate plants; in other cases a digit was dropped to broaden the scope of the industry in question. In the final listing, all industry groups were described to the third digit:

201X	Meat Products
202X	Dairy Products
203X	Canned and Frozen Foods
221X	Textile Mills
261X	Pulp Mills
347X	Metal Platers

3. Survey Analysis

The bulk of the study consisted of a survey that was conducted of both grantees and industry. The survey effort consisted of the following steps:

- Design of Data Instruments
- Orientation of Field Staff
- Conduct Pretest
- Survey Administration
- Summarization of Results

a. Design of Data Instruments

Conducting a survey of an essentially unregulated local government activity poses some major problems. The extremely diverse forces of custom, state and local regulation, and local discretion have combined to produce a wide array of methodologies and terminology in wastewater rate setting. This diversity was expected to pose a major diffculty in designing an instrument in such a way as to capture data that could be compared grantee-to-grantee.

Accordingly, a fairly structured approach was utilized in designing the survey instruments. The first step was to prepare a matrix relating specific issues from the Congressional debate to specific questions or data (see Exhibit II-3-1). This was then converted into an initial grantee survey instrument (see Exhibit V-1-7, Volume III). In preparing this initial survey instrument, the following factors were considered:

1. A limit was placed on the survey form and the length of time required for completion, because cooperation with the survey was voluntary.
2. Emphasis was placed on data that was anticipated to be readily available to the grantee.
3. Emphasis was shifted to costs by category and revenue by source, because of the multiplicity of rate setting and revenue-producing methodologies.

The development of the industrial survey instrument proceeded through a slightly different course. Initially, a survey instrument containing all potential areas of interest was developed jointly with the National Food Processors Association (NFPA) (Exhibit V-1-8, Volume III). This instrument was eventually utilized by NFPA in a survey conducted in conjunction with the

EXHIBIT II-3-1
1 of 6

U. S. Environmental Protection Agency
Industrial Cost Recovery Study
Issues Matrix

DEFINITION OF ISSUE	SPECIFIC QUESTIONS AND COMMENTS
1. Combined and incremental impact of user charges and ICR costs on five industries and on industries in thirty selected urban and non-urban communities	Grantee For one year prior to UC/ICR and first year of UC/ICR, what was total revenue by type, from residential customers and total revenue, by type, from non-residential customers. Grantee - Rate, prior to UC/ICR . by rate element (debt; O&M etc.) and billing unit . dates effective Current or proposed UCR/ICR rate . by rate element (debt; O&M; by volume; BOD; SS; ICR; etc.) and billing unit . dates effective Geographic location-urban or rural, old or new city Actual charges to selected industrial plants. For each - . 12 months prior to UC/ICR .. amounts billed - by rate element .. units billed .. periods billed

DEFINITION OF ISSUE	SPECIFIC QUESTIONS AND COMMENTS
	· 12 months prior to UC/ICR (actual or projected) .. amounts billed - by rate element .. units billed .. periods billed Selected Plants. For each - · Units of Industry Activity .. description .. amount of quantity .. time period · Geographic location · Urban and rural · Large or small business
· as a function of prevailing level of unemployment	Grantee Did any plants, due to UC/ICR: · close · reduce production · decide not to move into service area · move to different area
· incremental cost of collecting ICR over that incurred for user charges	Grantee What does it cost to bill and collect ICR? Identify specific cost components.
· P.L. 92-500 projects vs. P.L. 84-660	See Issue 1 above - rates
· old city vs. new city	See Issue 1 above - rates

DEFINITION OF ISSUE	SPECIFIC QUESTIONS AND COMMENTS
3. Cost of ICR monitoring and enforcement	Grantee What were monitoring and enforcement costs before UC/ICR? What are the monitoring and enforcement costs with UC/ICR? Which specific costs would be eliminated if there were no ICR?
4. Benefits to industry from exclusion of interest factor in ICR	Obtain estimated capital costs for self-treatment from C&L subcontractor for each selected plant.
5. ICR costs as a percentage of total expenses of industry	Grantee What are ICR costs and recovery period for each selected plant? Obtain total industry expense statistics and units of activity from Department of Commerce Develop relationship between . selected plant units of industry activity and total industry activity . ICR costs from issue 2 above and total for industry.
6. Comparison of industrial sewage cost in POTW vs. cost of direct charge	Obtain estimated cost to operate self-treatment plant from C&L subcontractor or EPA publications for each selected plant. Use estimated capital cost for self-treatment from issue 4 Use UC/ICR costs from issue 2

DEFINITION OF ISSUE	SPECIFIC QUESTIONS AND COMMENTS
7. Impact of ICR on selected national industrial growth patterns	See issue 2 - plant closings, relocation, etc.
8. Level of business closures caused by ICR	See issue 2 - plant closings, relocation, etc.
9. Impact of ICR on selected Inter-industry competition	Select the lower cost substitute for each industry and determine efect of ICR on that substitute industry.
10. Impact on ICR exemptions, including impacts related to . levels of flow . revenues forgone . cost of grantee administration	Select alternative ICR exemption techniques . flow . minimum $ amount Grantee For each alternative exemption technique and criteria, obtain . number of industries exempted . estimated ICR collections . reduction in ICR administrative cost
11. Impact of ICR on	See issue 2 above
. employment	See issue 2 above
. export import balance	
. local tax base	Grantee
. water conservation by industry	List 10 largest water users Contact those users who have reduced consumption to determine reason.
. small business	See issue 2 above for plant closings, relocations, etc.

DEFINITION OF ISSUE	SPECIFIC QUESTIONS AND COMMENTS
. economies of scale	Grantee During plant design or construction, did any industries choose not to participate? If any, identify . specific industries . estimated volumes
12. Encouragement of cost-effective solutions to (economies of scale) water pollution by ICR	What are the cost increases due to lost economies of scale? This issue will be addressed if, in issue 11 above, industries who chose not to participate were identified.
13. Alternative methods of excluding small business from ICR	See issue 10 above.
14. Extent of ICR cost disparities within Standare Metrropolitan Statistical Arrea, or within 50 miles of such areas	For each selected plant and the related industry group - Are there any other plants within the SMSA or 50 miles with significantly different ICR unit costs?
15. Relative treatment costs of secondary vs. advanced	Grantee What level of treatment do you provide? What are the unit costs for ICR? What is the design capacity of the plant?
16. Alternative methods of achieving ICR parity where disparities exist	Develop theoretical national ICR rates
17. Local government impacts of ICR . Revenue producted . Incremental costs . Other issues	See issue 1 above See issues 2 and 3 above

DEFINITION OF ISSUE	SPECIFIC QUESTIONS AND COMMENTS
	Grantee Are there any other ICR incremental costs not discussed previously?
.. dry industries	See issue 10 above
.. seasonal flow	Grantee Are there any seasonal flow industrial users? Who? Days of operation? Flow and strength?
.. alternative bases for inclusion in ICR (other than SIC)	Grantee What would the impact be to charge to the current industry definition? What would the impact be to exclude all sanitary waste?
.. critical review of Appendix A of ICR guidelines	Grantee Did you have difficulty in completing Appendix A? Which portion? Can you recomend an alternative form?
.. analysis of grantee payments for system development	Grantee Did you receive a grant amendment for development of the UC/ICR system? Amount? How utilized? What was the total cost to design and implement the UC/ICR system, by cost element - . consultants . public hearings . administration

ICR study. However, consultation with other industry associations produced a number of areas of concern:

1. Questions relating to either the costs of business or profits were deemed to be unacceptable, since the study was performed under the Freedom of Information Act.
2. A number of the industry groups (such as the paper and wood products groups) had just completed a very lengthy and detailed Section 308 survey from EPA. Therefore, the various associations felt that a shorter survey would produce a higher response rate.
3. Finally, it was determined that it would be most efficient to focus on industries located within grantee's geographical areas. This linkage reduced the information needed from industry, since much of the data would be obtained from the grantee.

b. Pre-Test

The resulting grantee survey instrument (Exhibit V-1-7, Volume III) was then pre-tested on a random sample of 13 grantees located in Region V. All pre-test surveys were administered in person. The pre-test responses were analyzed and necessary changes incorporated. Finally, the format of the survey form was modified to simplify data entry. The final survey form is shown in Exhibit V-1-2 Volume III.

The industrial survey form (Exhibit V-1-9, Volume III) was pre-tested in a different manner. The survey forms were reviewed with appropriate representatives of industry associations representing the target industries. Appropriate changes were made and the format modified to simplify data entry (Exhibit V-1-3, Volume III).

c. Field Staff Orientation

To meet the overall schedule requirements ten survey teams were established -five for the eastern half of the counry and five for the western half. The two survey groups (East and West) received training which covered the following topics:

- Introduction to Wastewater Treatment
- Wastewater treatment terminology
- Clean Water Act Amendments of '72 and '77
- Federal Rate Setting Requirements (User Charge and ICR)
- Survey Protocol
- Survey Techniques
- Administrative Aspects of the Survey

The training sessions were broken down as follows:

- Study Background, Survey Techniques, etc. -2 days
- Visit to Regional Office-Review of Documents on File (201 Facility Plans, UC/ICR systems, etc.) - 2 days

The purpose of the orientation was to:

1. Provide the necessary background in wastewater operations, legislation and study objectives, for the survey team members.
2. Insure that proper survey protocol was observed.
3. Insure consistency in the recording of data.

d. Survey Administration

The survey planning effort was initiated by obtaining from the EPA Grants Information and Control System (GICS) a listing of all grantees with approved UC/ICR systems. This listing was updated and corrected by review with the EPA Regional Offices. The initial survey target was to visit 100 grantees and to survey (either in person or over the telephone) as many of the grantees with approved systems as possible.

The list of candidate grantees was then circulated to all EPA Regions, EPA Headquarters personnel and Advisory Group members. The purpose of this screening was to identify those grantees of particular interest to the study due to:

1. The existence of industry of interest
2. Either a difficult or easy time in implementing ICR
3. Case study candidate (e.g. industries opting out of POTW, nearby non- ICR city, etc.)

The most promising grantees were then ranked to reflect regional economics (see Exhibit II-3-2) and an initial site survey list established.

EXHIBIT II-3-2

U.S. ENVIRONMENTAL PROTECTION AGENCY
ICR STUDY
SURVEY CANDIDATE SELECTION QUANTITIES

Region	% Total U. S. Pop + Value Added Manufacturing	Number of City Visits	% of City Visits
1 (Boston)	10	10	9
2 (New York)	10	9	9
3 (Philadelphia)	11.5	12	10
4 (Atlanta)	14.5	15	13
5 (Chicago)	25	29	25
6 (Dallas)	10	8	7
7 (Kansas City)	5	8	7
8 (Denver)	2	7	6
9 (San Francisco)	11	11	10
10 (Seattle)	3	5	4
Totals	100%	115 Cities	100%

For each grantee, the following procedure was followed:

1. A call was placed to the grantee explaining the purpose of the survey.
2. A letter was then mailed including the survey form.
3. After the survey form was received, a follow up call was placed to answer any questions and confirm participation in the study.

In the event the grantee was to be visited, a date was selected during the initial telephone call and confirmed in the follow up letter and telephone call.

In addition to the identification of plants of interest by the associations in the Advisory Group, Dun & Bradstreet directories were utilized to identify industries of interest (by SIC code) located in the cities to be visited*. These firms were then called and a follow up letter (along with the survey form) sent. All completed survey forms were reviewed by the survey team captain.

Of the estimated 300 grantees selected to be surveyed, completed survey forms were obtained from 227. Of those grantees not covered in the survey one of the following conditions existed:

1. A desire not to participate in the survey
2. Inadequate base of information
3. No industry

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*It should be noted that establishments with gross sales below $500,000 are not listed by D&B. As a result, we were forced to rely on association inputs in identifying very small businesses.

e. Summarization of Results

Following the review of the survey forms, all appropriate quantitative data was transferred to punch cards and, subsequently, transferred to tape. An EPA compatible software package known as IRS (Inquiry Reporting System) was utilized for data management.

Once all the data was on tape a number of edit and validity checks were performed. Some of these checks included:

- Was a numerical answer given where one was required?
- For certain numerical answers were they within acceptable ranges?
- Do sums add up?
- A number of internal validity checks (do certain answers exceed others ? etc.)

An error listing of all erroneous survey forms was produced. These forms were then corrected or needed data added.

Once the validation of the data was completed, a number of mathematical operations were performed. These operations included segmentation--by state, by SIC code, by grant (old or new), and by region (urban or rural).

4. Cost Function Analysis

One of the areas to be addressed by the study was the general issue of cost-effectiveness. Analysis of the impact of ICR on cost-effective solutions to water pollution required the use of a simulation model. The simulation model (described in the next section) employed two sets of capital and operating cost equations for secondary and advanced treatment. One set comprised first order national cost curves presented in EPA publication MCD-37, Construction Costs for Municipal Wastewater Treatment Plants: 1973-1977, and MCD-39, Analysis of Operations and Maintenance Costs for Municipal Wastewater Treatment Systems; the second set of cost equations were assembled for this study by Camp Dresser & McKee, Inc., a consulting engineering firm with which Coopers & Lybrand contracted for technical engineering assistance.

The EPA equations were based on logarithmic regression analysis of a large sample of POTW's. The equations employed in this study were national equations based on sample sizes of 97 for secondary capital costs, 40 for AWT capital costs, 143 for activated sludge secondary O&M costs, and 28 for AWT O&M costs. The EPA equations were based on flow only with no adjustment for influent BOD or SS levels. The specific EPA equations are presented below:

Capital Costs

Secondary Treatment	$C = 2.12 \times 10^6 \times Q^{.88}$
AWT	$C = 2.88 \times 10^6 \times Q^{.99}$

O&M Costs

Secondary (Activated Sludge)	$C = 8.25 \times 10^4 \times Q^{.96}$
AWT	$C = 6.85 \times 10^4 \times Q^{1.44}$

Camp Dresser & McKee (CDM) provided a second source of cost estimates based on their design experience in treatment plants.

The cost equations were built up from unit process cost estimates for specific process trains. Because the cost equations were based on process design experience, account was explicitly taken of the BOD and SS levels (expressed in mg/l) in influent as cost-causing attributes. CDM's estimates are presented below:

Capital Costs

Secondary (Activated Sludge)

$$C = 1.418 \times 10^6 \times Q^{.8} + 460 \times 10^3 \times \left|\frac{BOD}{200} Q\right|^{.82} + 465 \times 10^3 \times \left|\frac{SS}{200} Q\right|^{.81}$$

AWT

$$C = 1.789 \times 10^6 \times Q^{.8} + 460 \times 10^3 \times \left|\frac{BOD}{200} Q\right|^{.82} + 465 \times 10^3 \times \left|\frac{SS}{200}\right|^{.81}$$

O&M Costs

Secondary (Non-labor)

$$C = 17.2 \times 10^3 \times Q^{.87} + 15.1 \times 10^3 \times \left|\frac{BOD}{200} Q\right|^{.76} + 11.9 \times 10^3 \times \left|\frac{SS}{200} Q\right|^{.8}$$

Secondary Labor Man Hours $(Q \leq 7.5)$

$$MH = 5288 \times Q^{.41} + 1166 \times \left|\frac{BOD}{200} Q\right|^{.53} + 4853 \times \left|\frac{SS}{200} Q\right|^{.58}$$

Secondary Labor Man Hours $(Q > 7.5)$

$$MH = 3776 \times Q^{.58}$$
$$1166 \times \left|\frac{BOD}{200} Q\right|^{.53} + 3603 \times \left|\frac{SS}{200} Q\right|^{.74}$$

AWT (Non-Labor)

$$C = 33.6 \times 10^3 \times Q^{.83} + 11.9 \times 10^3 \times \left|\frac{SS}{200} Q\right|^{.53} + 15.1 \times 10^3 \times \left|\frac{BOD}{200} Q\right|^{.76}$$

AWT Labor Man Hours $(Q \leq 7.5)$

$$MH = 5706 \times Q^{.44} + 1166 \times \left|\frac{BOD}{200} Q\right|^{.53} + 4853 \times \left|\frac{SS}{200} Q\right|^{.58}$$

AWT Labor Man Hours $(Q > 7.5)\ MH = 4255 \times Q^{.59} + 1166 \times \left|\frac{BOD}{200} Q\right|^{.53} + 3603 \times \left|\frac{SS}{200} Q\right|^{.74}$

Exhibit II-4-1, and related Exhibits II-4-2 thru II-4-5 present capital and O&M cost estimates for plants of varying sizes based on the two cost estimating sources employed in this study. In order to convert the man-hour estimates generated by CDM into equivalent dollar amounts, estimates of annual labor costs by size of plant and treatment level were taken from MCD-39, (Table 4-10).

As employed in this study, the equations were assumed to apply equally to public and private treatment works, because there appears to be no technological basis on which to state that the presence of pretreatment facilities should lower either capital or O&M costs to the firm. Pretreatment costs were not factored into firm decision making, since these costs are not avoidable to the firm regardless of whether public or private treatment is selected.

The other assumption is that a firm would have to provide some POTW-type treatment in self treatment. Recognizing tht in reality, this firm would hve to provide BPT or BAT, this assumption is nevertheless a valid and practical one for the purpose of this study. The cost to a firm to provide BPT may vary from the cost to provide a POTW-type secondary treatment, however, the varianace is considered to be within a reasonable range, and the average of BPT costs approximates that of the

POTW-type secondary treatment costs. The same inference can be made in the case of comparing the cost to a firm providing BAT with the cost of providing POTW-type AWT of secondary treatment and appropriate pretreatment. Factors which impact the costs to provide BAT or BPT, and the costs to join a POWT include, but are not limited to, the size and type of an industry, the size and type of a POTW, and its specific geographic economical and demographic conditions. Each combination of those factors may create a unique cost-effective case, and must be evaluated on a case-by-case basis.

Exhibit II-4-1

Estimated Capital and Operating Costs for Secondary and AWT Plants

Capital Cost ($1,000's)

	Secondary Treatment		AWT	
Flow (MGD)	EPA	CDM*	EPA	CDM*
1	2,120	2,617	2,880	2,998
5	8,738	9,590	14,170	10,935
10	16,082	16,779	28,144	19,120
20	29,082	29,357	55,900	33,432
30	42,287	40,722	83,511	46,359
40	54,469	51,365	111,028	58,461
50	66,287	61,501	138,475	69,984

O&M Costs ($1,000's)

Flow (MGD)	EPA	CDM*	EPA	CDM*
1	83	139	69	161
5	387	389	695	462
10	752	657	1,887	789
20	1,464	1,101	5,119	1,322
30	2,160	1,533	9,178	1,813
40	2,847	1.903	13,889	2,250
50	3,527	2,251	19,152	2,662

---

* Influent BOD and SS levels were assumed to be 275 mg./liter each.

Exhibit II-4-2

Estimated Capital Costs - Secondary Treatment

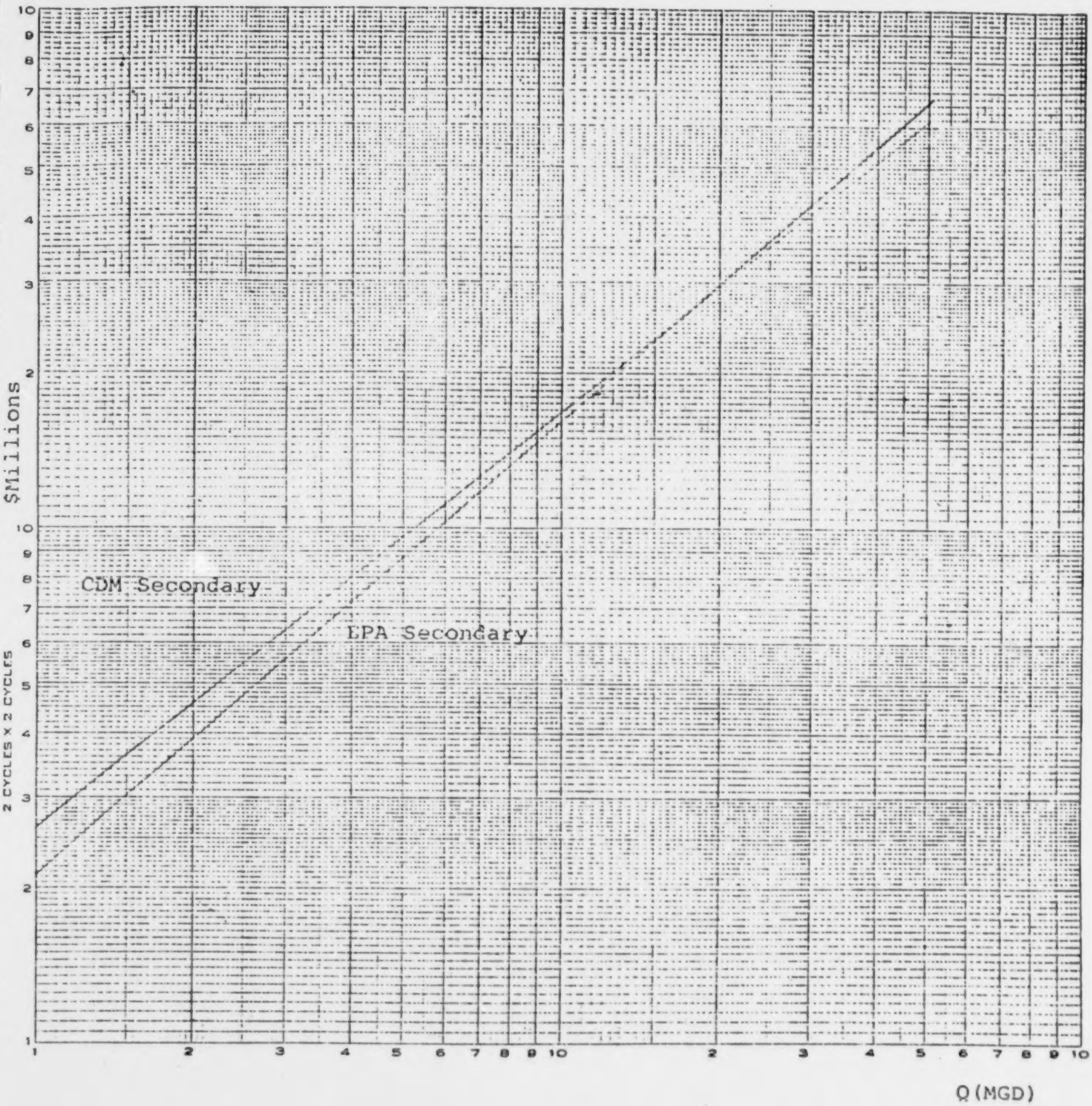


Exhibit II-4-3

Estimated Capital Costs - Advanced Waste Treatment

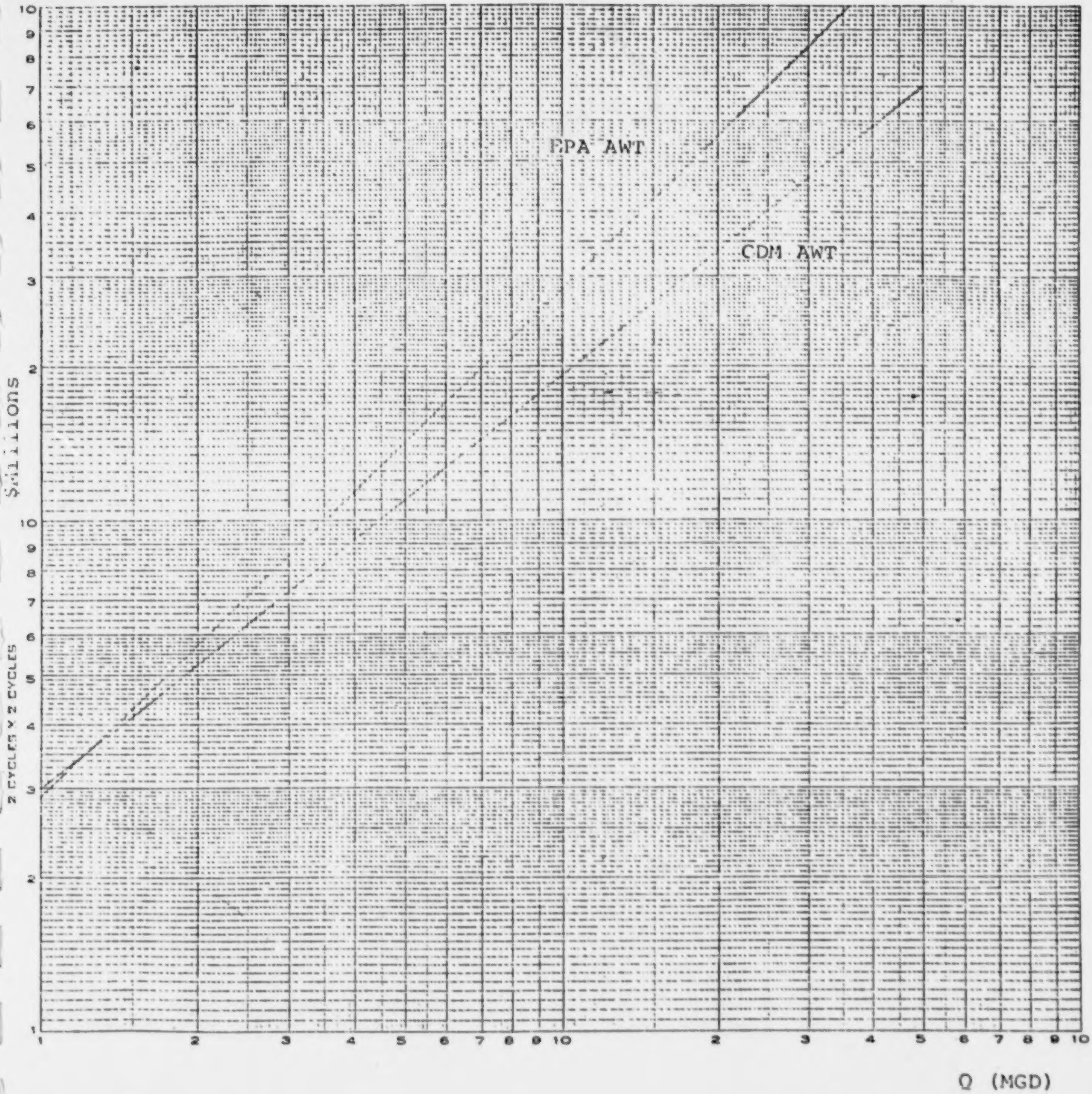


Exhibit II-4-4

Estimated O & M Costs - Secondary Treatment

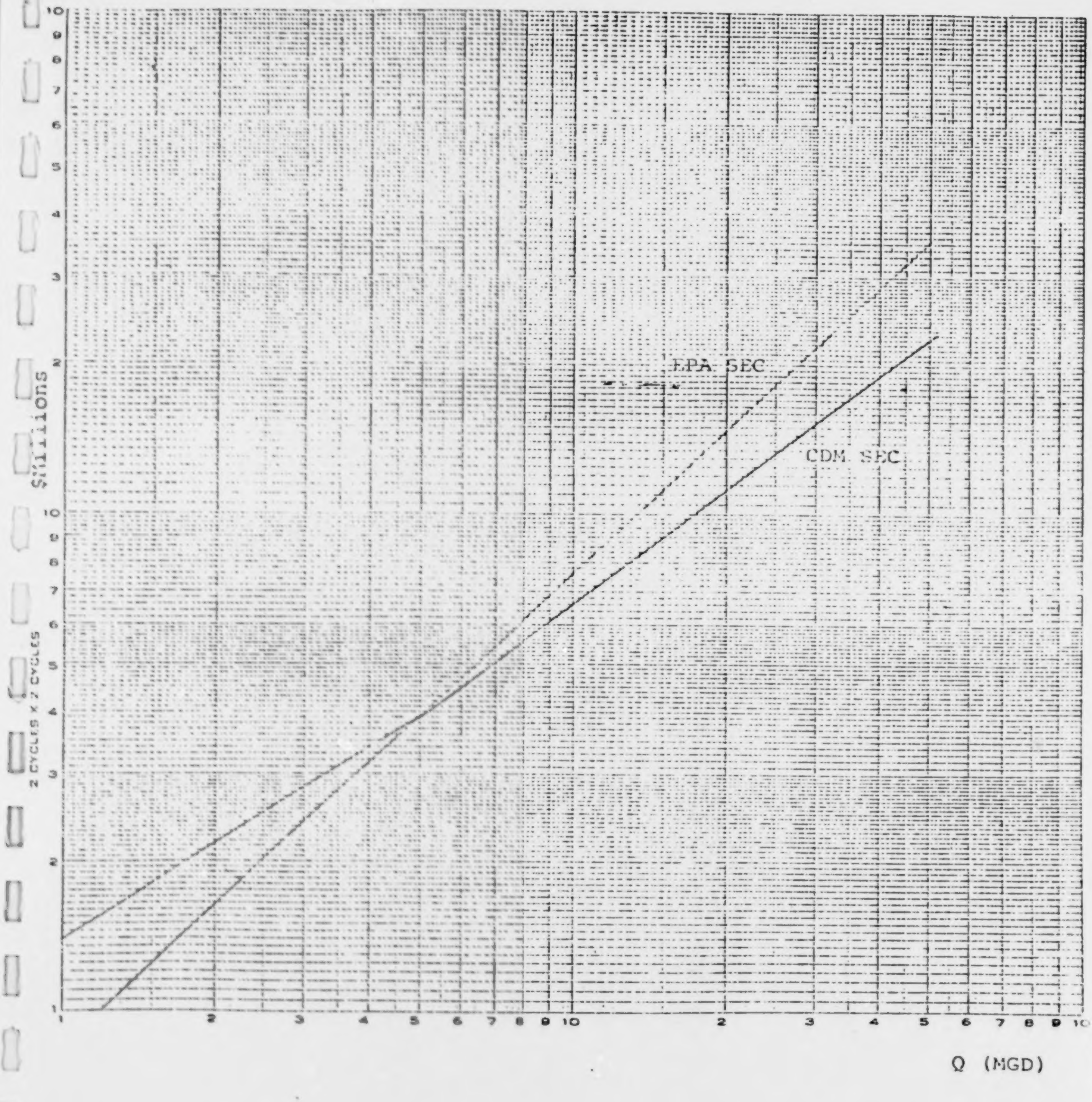
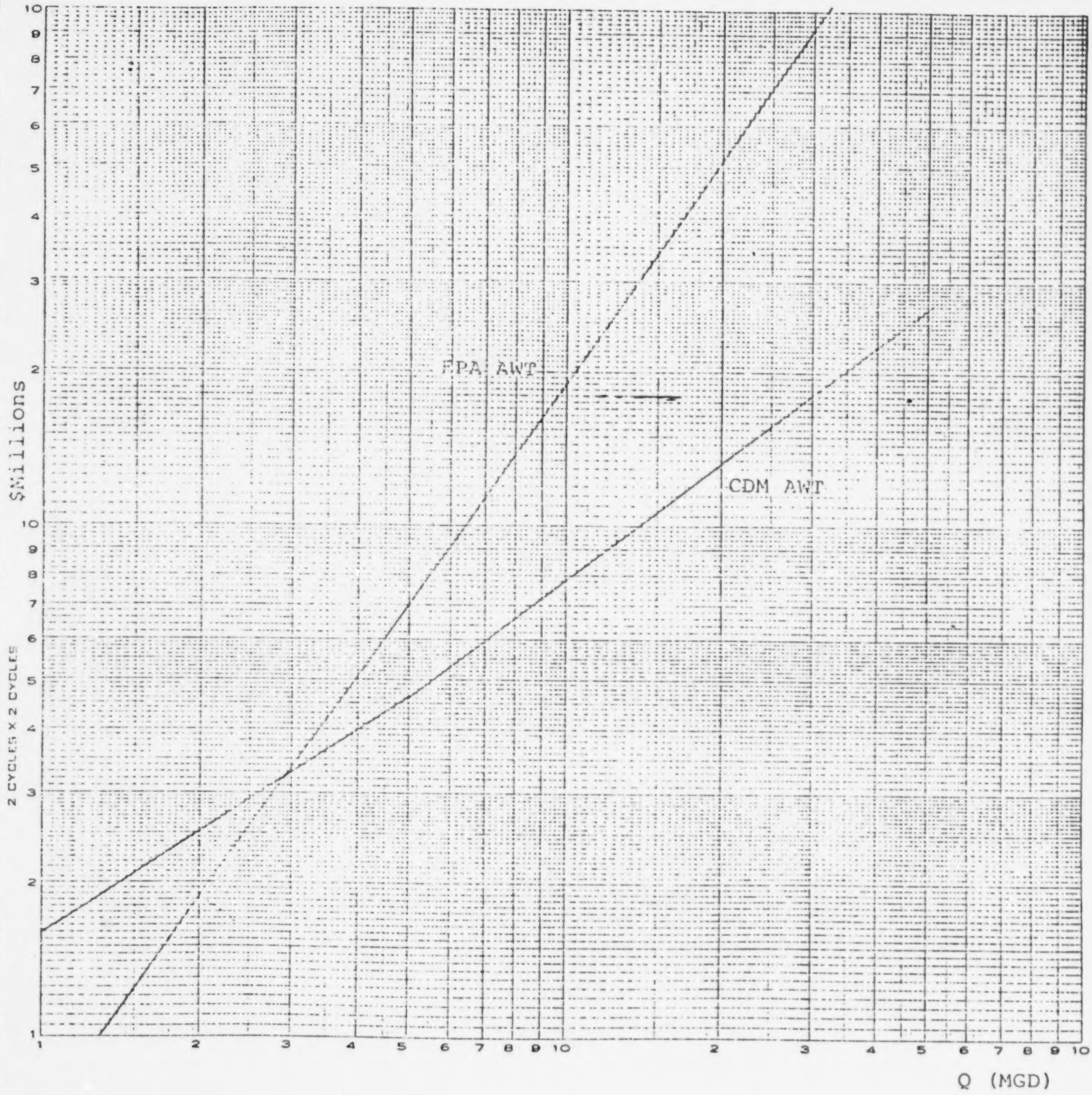


Exhibit II-4-5

Estimated O & M Costs - Advanced Waste Treatment



5. Financial Simulations

The focus of the economic analysis of the ICR system concentrated on the following questions:

1. What are the economics of the decision on the part of a plant to participate in a local POTW or self-treat?
2. How is the decision function in (1) dependent on the size of the plant?
3. How extensive are the economies of scale in POTW's and what impact do such economies have on ICR rates?
4. To what extent if any does ICR lead to a divergence of private and social costs of treatment?

While a direct "before and after" analysis of industries subject to ICR rates would be the natural approach, a record of experience sufficiently long to allow for even intermediate-term adjustments was not available.

The quantitative approach employed given this absence of empirical evidence was one of simulation or modeling. As previously discussed, an experienced consulting engineering firm (CDM) was engaged to provide cost equations for the various elements in the range of treatment alternatives faced by industry. These data were employed to yield simulation models reflecting the cost of self-treatment versus POTW tie-in, with and without ICR rates superimposed. By observing the shift in the set of opportunity costs-advantageous to self-treatment, a measure of ICR impact was obtained.

Financial Considerations

A brief discussion of the major financial elements entering into the analysis is presented below:

a. Capital and Operating Costs. A discussion of the methodology employed to estimate capital costs and O&M costs is presented in Chapters III and IV of this report. For purposes of this analysis, it has been assumed that the same cost equations are applicable both to individual firms and to POTW's. The major distinction drawn is in the scale of the plant as measured by flow.

b. ICR Payments. ICR payments faced by the firm were assumed to be determined on the basis of flow, with no differential charges for BOD, SS, or other effluent characteristics. It was assumed that the recoverable Federal monies represented 75% of the total POTW capital costs (C). These were allocated to the firm on the basis of the ratio of the firm's flow (Q_{firm}) to total flow (Q_{POTW}). Finally, the allocated portion of capital costs were annualized by dividing by POTW plant life (L). Thus, the annual ICR charge faced by the firm was calculated as:

$$ICR = (Q_{firm}/Q_{POTW}) \times (.75 \times C/L).$$

c. User Charges. User charges faced by the firm were assumed to be based on flow only and represent a share of annual O&M costs in the POTW (OM_{POTW}) factored by the ratio of the firm's annual flow to total POTW annual flow. Thus the user charge was calcuated as:

$$UC = (Q_{firm}/Q_{POTW}) \times OM$$

d. Local Finance Charges. The local share of capital costs were assumed to represent 25% of total capital costs. For purposes of the analysis, the locality was presumed to finance its share of the plant costs through debt issuance at a specified interest rate (r_m). Provision for debt retirement and interest payment was assumed to be in the form of a sinking fund with annual contributions from users in proportion to their flow. Thus assuming a bond term equal to plant life (L), the firm's local debt retirement charge (LDR) was calculated to be:

$$LDR = (Q_{firm}/Q_{POTW}) \times (25 \times C) \times \frac{r_m \times (1 + r_m)^L}{(1 + r_m)^L - 1}$$

e. Tax Rate. For purposes of calculating the post-tax cash flows, the effective tax rate was assumed to be 48%, the marginal Federal corporate tax rate. Because of the myriad state and local laws it was decided that consideration of non-Federal taxes was not practical. There was insufficient time available to revise the entire analysis to reflect the recent reduction in Federal tax rates to 46%.

f. Investment Tax Credit. The investment tax credit is a tax reduction based on a portion of qualified investment (Section 38 property) as defined by the Internal Revenue Code placed in service in a particular tax year. The provisions of the law with respect to the investment tax credit are complex and include limitations on qualified investment, limitations on the amount of tax which may be offset with the tax credit, carryover provisions, and other considerations. For purposes of this analysis the tax credit was assumed to be 10%, the full capital cost constituted Section 38 property, and sufficient income tax liability was incurred in the applicable year such that the full credit could be taken in the first applicable year. Certain limitations with respect to the tax credit basis arising out of an election to take rapid write-off of pollution control equipment is discussed below.

g. Depreciation. Provision is made in the tax law for exclusion of depreciation charges from taxable income. These depreciation charges are to be computed in accordancce with procedures consistent with the Internal Revenue Code. Although many methods are available, accelerated methods in the form of double declining balance (DDB) or sum-of-years-digits (SYD) are most common. For purposes of this analysis the computer model selected either SYD or DDB with switchover to straightline on the basis of whichever method resulted in the greatest present value benefit. Limitations on depreciable basis arising out of rapid write-off of certain pollution control property is discussed below.

h. Rapid write-off. Section 169 of the Internal Revenue Code specifies that certain pollution control facilities may be amortized over a five-year period. Certain criteria with respect to certification of the facility, the profit-making potential of the facility, and other requirements must be met. This analysis has assumed that the self-treatment facilities involved are qualified Section 169 facilities, that their entire cost is Section 169 property, and that they are not profit-making pollution abatement works.

The firm may elect to take Section 169 rapid writeoff at its discretion. Certain limitations with respect to depreciation charges and the investment tax credit are detailed in Sections 169 and 46 of the Internal Revenue Code. These limitations were factored into the computer model employed in this analysis. In particular, the amortizable basis is subject to limitations with respect to the useful life of the property: where the useful life of the property is in excess of 15 years, the amortizable basis (B_{169}) is a proportion of the otherwise amortizable basis (C) determied by the ratio of 15 years to the useful life of the property (L). Thus:

$$B_{169} = C \text{ for } L \leq 15,$$

$$B_{169} = \frac{15}{L} \times C \text{ for } L > 15.$$

The excess basis in cases where the facility life exceeds 15 years is subject to normal tax depreciation under Section 169 as discussed above. Therefore, in the case where useful life exceeds 15 years, it has been assumed that $\frac{15}{L} \times C$ may be written off over five years, and that $(1 - \frac{15}{L}) \times C$ may be depreciated using one of the accelerated depreciation methods.

The Tax Reform Act of 1976 provided that in cases where Section 169 rapid amortization was elected, the investment tax credit would be made available, but the basis for that credit would be reduced to 50% of the otherwise eligible investment amortized under Section 169. Thus under these provisions, the tax credit rate would effectively be 5% rather than 10% on that portion of the investment amortized over five years. The recent tax law changes removed this limitation, except with respect to facilities financed through Industrial Development Bonds (discussed below). This latter change was not factored into the computer model and the calculations were made on the basis of the law as amended by the 1976 Act, because of schedule limitations on the ICR Study.

i. Financing. The investment in self-treatment facilities must be financed by the firm either through debt or equity capital, or most commonly a combination of the two. In order to accommodate a wide range of possibilites, the computer model was structured to accept as input the share of total capital costs financed by debt and the annual interest charge on the debt.

Debt financing is of particular significance in light of the tax laws. Because interest payments are tax-deductible expenses, the effective cost of debt may be significantly lower than the nominal cost. Specifically, if the interest rate on certain debt is denoted r and the tax rate is denoted t, the after-tax cost of debt is $(1-t) \times r$ which, given current tax laws, may be in the range of one-half of the nominal pre-tax rate r.

Special consideration of Industrial Development Bonds is appropriate. Under current tax law, interest received from qualified Industrial Development Bonds issued to finance pollution control equipment is tax-free. Consequently, IDB's typically carry significanly lower interest rates than normal industrial bonds. This provision makes the IDB a particularly attractive financing vehicle for a firm considering self-treatment.

j. Methodology. The approach embodied in the computer model was predicated on the assumption that a firm would desire to self-treat if the present value of the after-tax cash flow impacts of POTW tie-in produced a greater reduction in wealth than those impacts from self-treatment.

Annual cash flow impacts from municipal tie-in include user charges (UC), ICR charges (ICR) and local share financing (LDR). Because these are tax deductions, the after-tax impact on cash flow in period j is:

$$CF_j^{POTW} = - (1 - t) \times (UC_j + ICR_j + LDR_j)$$

where UC, ICR, and LDR are as specified above.

Annual cash flow impacts from self treatment reflect many more elements than the municipal tie-in. In particular, the after-tax cash flow impact in period j under self-treatment is:

$$CF_j^{self} = t \times (A_j + D_j) - (1 - t) (I_j + OM_j) + ITC_j - P_j$$

where A and D are amortization and depreciation charges, I is interest on debt, OM is operating expense, ITC is the investment tax credit, and P is the applicable principal payment on debt.

The necessary technical and financial parameters were input into the computer which calculated POTW and firm capital and O&M costs on the basis of flow. The computer then optimized with respect to amortization and depreciation options available under self-treatment to arrive at the algebraic maximum present value after-tax cash flow impact under self-treatment, as well as calculating the POTW's ICR, O&M, and LDR charges to the firm and the present value after-tax impact of a municipal tie-in. The results were displayed in tabular form showing the ratio of present value of muncipal to self treatment costs for POTW flows of from 5 to 50 MGD, and for self-treatment flows of from .25 to 20 MGD. A ratio exceeding unity for any POTW/firm flow combination would indicate that municipal tie-in would be more costly than self-treatment under the assumed parameterization.

To determine the impact of ICR payments, then, it was necessary only to rerun the program excluding the ICR segment of municipal tie-in charges. The recalculated ratios would indicate which POTW/firm flow combinations shifted from disadvantageous to advantageous with respect to municipal tie-in, i.e., which ratios shifted from greater than one to less than one.

III. DETAILED FINDINGS AND ALTERNATIVES

1. General

The purpose of this chapter is to present the study's findings, as well as the alternatives developed. In general, the study requested that measurements be taken of a program that is still in its infancy, always a difficult task. In this case there are two reasons that it is difficult to take precise and quantitative measures of the effects and impacts of Industrial Cost Recovery. First, the program is only a few years old and industry has had relatively little time to measure the impacts of User Charges and Industrial Cost Recovery and compare these impacts with other changes facing industry. The second complicating factor is that during the moratorium EPA is no longer withholding grant payments for failure to develop ICR systems. Therefore, grantees are spending little time and energy calculating new ICR rates or updating rates for POTW's that are now functioning. It was for this reason that Coopers & Lybrand examined the intent of P.L. 92-500 and relied upon simulation (a technique used to identify how industry should act, discussed in detail in the next section of this report) rather than solely relying on a few measurements to determine whether the intent was being fulfilled.

As discussed earlier, the legislative intent behind ICR was to:

- Create rate parity between industries discharging to POTW's and those required to self-treat.

- Encourage proper sizing of treatment works.
- Encourage water conservation.
- Self-sufficiency retainment of ICR revenue by grantees for future upgrading and expansion of their POTW.

In addition to responding to the Legislative intent, the study was to address specific economic questions, including the questions entered in the Congressional Record by Congressman Roberts on December 15, 1977. The following sections of this chapter discuss the assumptions and findings of the study, based on the areas the study was asked to address. Chapter IV discusses the conclusions drawn from the findings presented in this Chapter. Basically, the study has found that Industrial Cost Recovery as currently formulated is not accomplishing the goals set forth in the Legislative intent. The issue of intent was studied using simulation; specific economic issues, and Congressman Roberts' questions were addressed using quantitative measurement where available. The lack of empirical data (because of the relative newness of ICR) shows that ICR has had relatively little quantifiable effect to date. However, the future effects of ICR appear to be discernible. The case studies presented in Chapter III are designed to highlight situations that may develop into trends if ICR is reinstituted after the moratorium.

2. Impacts of ICR (Economic)

Because the ICR program has been only partially implemented, and because many of those ICR programs in place have suspended their charges, essentially no empirical data is available on which a conclusive "before-and-after" analysis could be based. Moreover, it would be unreasonable to expect that in the short period during which these rates have been in place, any significant portion of industry's ultimate long-run adjustments have been made.

Nevertheless, economic theory can be employed to determine what long-run adjustments will ultimately result qualitatively, though not quantitatively relative to the industry's productivity and costs.

It is assumed at the outset that the firm employs two factors of production, labor (L) and capital (K), to produce a single product (Q). The production function f(K,L) is assumed to have continuous first and second order partial derivatives. Further, it is assumed that as a by-product to this production process effluent waste (W) is generated, and that the quantity of waste produced is an increasing function of the level of output. The firm sells its output at a fixed price, P_Q, and is charged a fixed unit rate, P_W, for its effluent discharge. The Firm's profit function (¶) which it is assumed to maximize is, then, revenue, P_QQ, less factor expenses, rK and vL, and less effluent charges, P_WW. Restated,

$$\P = P_QQ - rK - vL - P_WW$$

and

$$Q = f(K,L) \quad (f_K, f_L, f_{KL} > o;\ f_{KK}, f_{LL} < o)$$

and

$$W = g(Q) \quad (g' > o).$$

The first order conditions for profit maximization imply:

$$\partial \P / \partial K = P_Qf_K - r - P_Wg'\, f_K = o$$

and

$$\partial \P / \partial L = P_Qf_L - v - P_Wg'\, f_L = o$$

Restated, these conditions imply that the firm employs each factor of production up to the point at which the factor's marginal cost equals the net marginal revenue product. That is,

$$(P_Q - P_Wg')\, f_K = r$$

and

$$(P_Q - P_Wg')\, f_L = v.$$

Note that the effluent charge enters in a manner exactly analogous to a sales tax in the sense that it constitutes a wedge between the market price of the item, P_Q, and the net revenue to the firm after effluent charges, $(P_Q - P_Wg')$.

For the sake of simplicity, and with little loss of generality, assume that effluent generation is proportional to the amount of output, i.e.,

$$W = kQ.$$

Then profit maximization implies

$$P_Q f_K - r - P_W k f_K = o$$

and

$$P_Q f_L - v - P_W k f_L = o.$$

The second order condition required by profit maximization is that the Jacobian matrix

$$J = \begin{pmatrix} (P_Q - P_W k)\, f_{KK} & (P_Q - P_W k)\, f_{KL} \\ (P_Q - P_W k)\, f_{KL} & (P_Q - P_W k)\, f_{LL} \end{pmatrix}$$

posess a positive determinant $|J|$, since it has already been assumed that both f_{KK} and f_{LL} are negative.

The question to be answered, given this model, is: What will be the effect of an increase in the effluent charge, P_W? To answer this question the total differential of the first order conditions is required. That is, differentiating:

$$\begin{pmatrix} (P_Q - P_W k)\, f_{KK} & (P_Q - P_W k)\, f_{KL} \\ (P_Q - P_W k)\, f_{KL} & (P_Q - P_W k)\, f_{LL} \end{pmatrix} \begin{pmatrix} dK^* \\ dL^* \end{pmatrix} = \begin{pmatrix} k f_K dP_W \\ k f_L dP_W \end{pmatrix}$$

Here the "*" indicates optimal quantities employed of the factors of production, K and L. Employing Cramer's rule and taking advantage of the known signs of the derivatives f_K, f_L, f_{KL}, f_{KK}, and f_{LL} as well as the sign of $|J|$, the factor impacts are:

$$dK^*/dP_W = |J|^{-1} [k\,(P_Q - P_W k)\, f_K f_{LL} - k\,(P_Q - P_W k)\, f_L f_{KL}] < o$$

and

$$dL^*/dP_W = |J|^{-1} [k\,(P_Q - P_W k)\, f_L f_{KK} - k\,(P_Q - P_W k)\, f_K f_{KL}] < o.$$

In other words, an increase in the unit effluent charge P_W, whether labelled "user charges" or ICR charges, will lead to decreased employment of both labor and capital. Further, note that

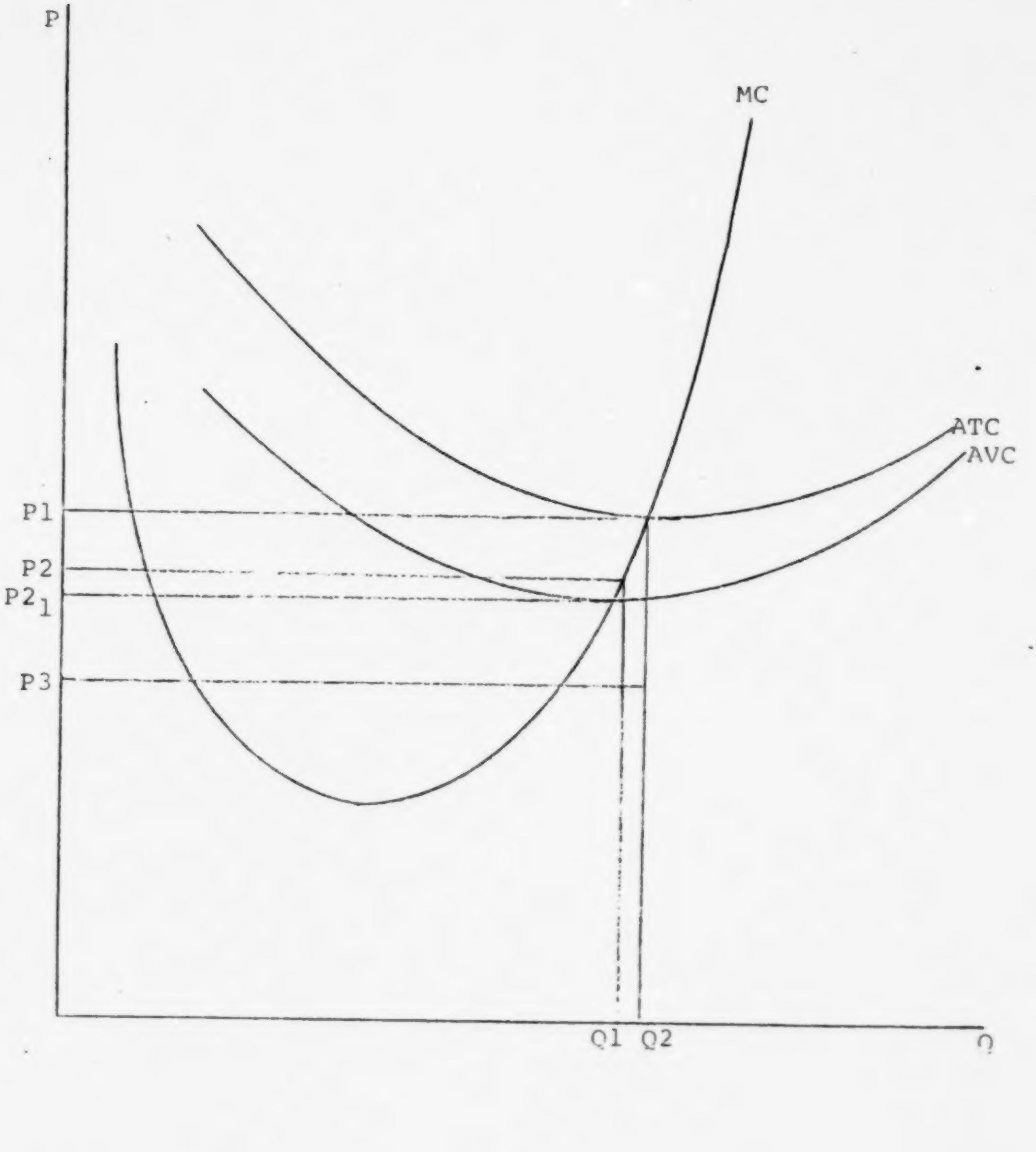
$$^{dQ}/dP_W = f_K\ ^{dK}/dP_W + f_L\ ^{dL}/dP_W < o$$

That is, the increase in P_W will also lead to lower levels of output.

Graphically, Exhibit III-2-1 illustrates the impact of an increase in the effluent charge P_W on the firm's decision. The

Exhibit III-2-1

Cost and Output Impact of ICR on the Firm



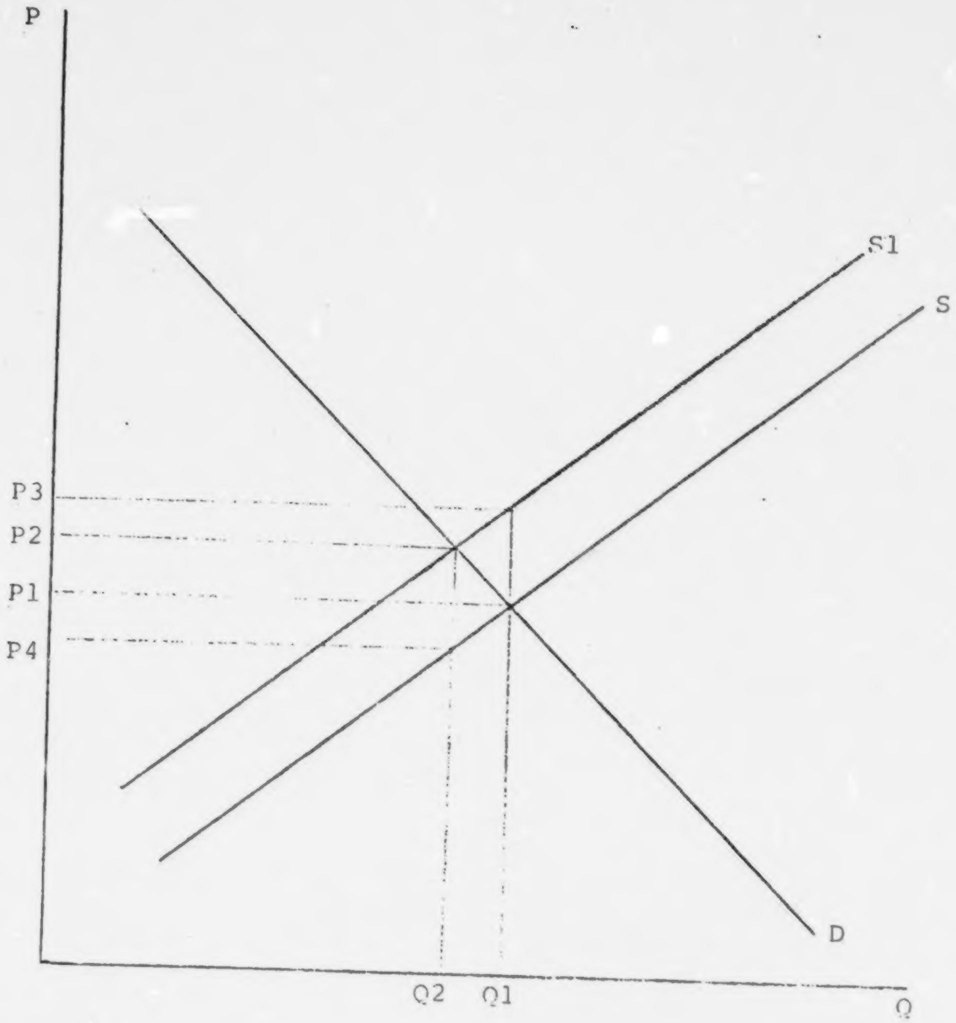
influence of the increase is reflected in the downward shift in the price line from P_1 to P_2 to illustrate the decrease in received revenues (net of the charge). In the case of a shift from P_1 to P_2 the level of output is decreased from Q_1 to Q_2 reflecting the firm's adjustment to the lower net revenue. This is a short run adjustment, however, since the firm is no longer covering all of its fixed charges. In the longer run, further adjustment would be expected in scale of plant.

Were the shift in the charge sufficient to move the price line from P_1 to P_3 (any point below say $P_2{}^1$), the firm would simply shut down. In this case it would no longer be covering all of its variable costs and could in effect minimize its losses by closing down rather than continue operation in the short run.

The impact of an increase in effluent charges on the market for a good is illustrated in Exhibit III-2-2. The effluent charge increase is reflected in the vertical shift of the supply curve from S to S^1 in the amount of the increase in P_W, P_3-P_1. That is, in order for the same quantity of product, Q_1, to be forthcoming following the imposition of the increase, the received price (net of the charge) must remain at P_1. Thus P_3 represents the old price plus the increase in the effluent charge.

Exhibit III-2-2

Price and Quantity Impact of ICR on an Industry



Given the new supply curve, S^1, and no shift in the demand curve, D, the new equilibrium price will be P_2 which will exceed the old price but, in general, will be less than P_3. Further, the quantity of industry output will decline from Q_1 to Q_2. The relative share of the increase in effluent charges borne by the consumer, $[(P_2 - P_1)/(P_2 - P_4)]$, and by industry, $[(P_1 - P_4)/ (P_2 - P_4)]$ will vary according to the elasticity of supply and demand for the industry's product. Except in very unusual circumstances, however, it is clear that both industry and the consumer will bear a portion of the incremental cost.

In summary, the following qualitative implications follow from the economic analysis:

- ICR will lead to reductions in labor and capital employed by the firm as well as reduced output;
- ICR may force some plants to shut down in the short-run;
- ICR may lead to lower industry output and higher prices;
- ICR - induced price increases will be borne by both consumers and producers.

3. Simulation Analysis (financial)

The primary objective of the above economic simulation analysis was to supplement the survey data results, which were expected to show little evidence of the scope and nature of the ultimate long-run impacts of ICR on industry's productivity and cost. The financial simulation analysis as described in Section II.4 and II.5 of this report was designed to indicate, under varying financial and technical assumptions, the relative costs of tie-in to a municipal wastewater treatment plant versus self-treatment of industrial effluent. The conclusion of this simulation analysis can be stated simply: it appears that under certain conditions, especially related to available financing, there is a sometimes strong incentive to self-treat rather than to utilize a POTW.

Exhibit III-3-1 (consists of 22 pages at the end of this Section) details the matrix output of the simulations based on varying assumptions with respect to the financial and technical parameters. Each table reflects for various POTW flows (columns) and assumed industrial plant flow (rows), the ratio of the present value of the after tax cash flow impact of remaining in the POTW to the present value of the post-tax impact of self-treatment. A second set of tables (15 - 22), reflect the cost-effectiveness ratios computed in the absence of ICR charges, but with user charges and local debt service charges left in place.

The reader should bear in mind that all POTW charges are presumed to be based exclusively on flow and do not reflect individual user's BOD and SS loads in differential rates for ICR, UC, or local debt service.

Interpretation of the tables is straightforward, i.e., there is presumed to be a positive incentive to self-treat in each case in which the cost effectiveness ratio exceeds unity. As a generalization the incentive to self-treat increases as the size of the industrial user relative to the POTW increases.

Similarly, the incentive increases as the debt share of project financing increases and as the interest rate on the debt financing decreases.

The simulations of AWT under the EPA cost estimates stands in contrast to the other simulations with respect to the shift in incentive from a change in the plant flow relative to the POTW flow. Specifically, while in non-EPA-AWT cases the incentive to self-treat increases as the plant flow increases relative to POTW flow, in the EPA-AWT cases the effect is exactly reversed: the incentive to self-treat increases as the plant flow decreases relative to POTW flow. This phenomenon reflects the fairly strong diseconomies of scale in the EPA's estimate of AWT O&M cost which imply a more than proportional reduction in cost for a given proportionate reduction in flow.

It is apparent from the financial simulations that the strongest incentives to self-treat arise when the debt-financed share of capital costs is high (higher than typical debt ratios). The case was included to allow not only for the consideration of long term debt financing through specific or blanket liens, but most especially to allow for the opportunity to finance a project with the proceeds of an industrial development bond which typically carries a much lower interest rate than normal corporate debt due to its tax-free interest to the recipient. (See the discussion in volume 2 of this study.)

The use of industrial development bonds as a means of finance appears to be relatively wide-spread with 192 new issues in 1977 listed in the 1978 volume of Moody's Bond Record; these do not include private placements for which no estimate could be made. It has been argued that the proceeds must exceed $1 million before it is economical to issue an IDB because of the fixed charges of issuance. However, ten percent of the new IDB's listed were in amounts under $1 million and in a number of instances issues were made in the range of $300,000. The availability of this low interest financing has recently been extended to smaller business through an amendment to the Small Business Investment Act which provides SBA guarantees against default in the borrowing. Thus, this vehicle may be expected to become significantly more important to the smaller industrial plant.

These simulations suggest that there are instances in which it is desirable for a plant to withdraw from its POTW and self-treat. The fact that relatively little drop-out has been observed may be attributed to the relatively short time in which the charges have been implemented, and to the suspensions of ICR payments in most locales. It appears that this finding results from the use of either EPA's cost curves or from the use of CDM's cost curves.

Exhibit III-3-1

Table 1

Ratio of POTW to Self-Treatment Present Value Costs

PLANT	POTW LOAD (MGD)									
LOAD	5	10	15	20	25	30	35	40	45	50
0.25	0.502	0.475	0.460	0.450	0.442	0.436	0.430	0.426	0.422	0.419
0.50	0.537	0.508	0.492	0.481	0.473	0.466	0.460	0.456	0.452	0.448
0.75	0.559	0.528	0.512	0.500	0.492	0.485	0.479	0.474	0.470	0.466
1.00	0.574	0.543	0.526	0.514	0.505	0.498	0.492	0.487	0.483	0.479
2.00	0.614	0.581	0.562	0.550	0.540	0.532	0.526	0.521	0.516	0.512
3.00	0.638	0.603	0.584	0.571	0.561	0.553	0.547	0.541	0.536	0.532
4.00	0.655	0.620	0.600	0.587	0.577	0.568	0.562	0.556	0.551	0.546
5.00	0.000	0.633	0.613	0.599	0.586	0.580	0.574	0.568	0.562	0.558
6.00	0.000	0.644	0.623	0.610	0.599	0.590	0.583	0.577	0.572	0.568
7.00	0.000	0.653	0.633	0.618	0.608	0.599	0.592	0.589	0.580	0.576
8.00	0.000	0.661	0.640	0.626	0.615	0.607	0.599	0.593	0.588	0.583
9.00	0.000	0.669	0.648	0.633	0.622	0.613	0.606	0.600	0.594	0.589
10.00	0.000	0.000	0.654	0.639	0.628	0.619	0.612	0.606	0.600	0.595
15.00	0.000	0.000	0.000	0.664	0.652	0.643	0.635	0.629	0.623	0.618
20.00	0.000	0.000	0.000	0.000	0.670	0.660	0.652	0.646	0.640	0.635

Cost Equations: EPA Secondary

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 50%

Borrowing Rate: Corporate: 9% Municipal: 7.5%

Table 2

Ratio of POTW to Self-Treatment Present Value Costs

PLANT	POTW LOAD (MGD)									
LOAD	5	10	15	20	25	30	35	40	45	50
0.25	0.717	0.678	0.656	0.642	0.630	0.621	0.614	0.608	0.602	0.597
0.50	0.761	0.720	0.697	0.682	0.670	0.660	0.653	0.646	0.640	0.635
0.75	0.789	0.746	0.722	0.706	0.694	0.684	0.676	0.669	0.663	0.658
1.00	0.809	0.765	0.741	0.724	0.712	0.701	0.693	0.686	0.680	0.674
2.00	0.858	0.812	0.786	0.768	0.755	0.744	0.735	0.728	0.721	0.715
3.00	0.888	0.840	0.814	0.795	0.781	0.770	0.761	0.753	0.747	0.740
4.00	0.910	0.861	0.833	0.815	0.801	0.789	0.780	0.772	0.765	0.759
5.00	0.000	0.877	0.849	0.830	0.816	0.804	0.795	0.786	0.779	0.773
6.00	0.000	0.890	0.862	0.843	0.828	0.817	0.807	0.799	0.791	0.785
7.00	0.000	0.902	0.873	0.854	0.839	0.827	0.817	0.809	0.801	0.795
8.00	0.000	0.912	0.883	0.863	0.848	0.836	0.826	0.818	0.810	0.804
9.00	0.000	0.921	0.892	0.872	0.857	0.845	0.834	0.826	0.818	0.812
10.00	0.000	0.000	0.900	0.879	0.864	0.852	0.842	0.833	0.826	0.819
15.00	0.000	0.000	0.000	0.909	0.893	0.881	0.870	0.861	0.854	0.847
20.00	0.000	0.0000	0.000	0.000	0.915	0.902	0.891	0.882	0.874	0.867

Cost Equations: EPA Secondary

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 75%

Borrowing Rate: Corporate: 9% Municipal: 7.5%

Table 3
Ratio to POTW of Self-Treatment Present Value Costs

PLANT	POTW LOAD (MGD)									
LOAD	5	10	15	20	25	30	35	40	45	50
0.25	1.088	1.029	0.996	0.974	0.957	0.944	0.932	0.923	0.914	0.907
0.50	1.143	1.081	1.047	1.024	1.006	0.992	0.980	0.970	0.961	0.953
0.75	1.176	1.113	1.077	1.053	1.035	1.020	1.008	0.998	0.989	0.981
1.00	1.200	1.135	1.099	1.075	1.056	1.041	1.029	1.018	1.009	1.001
2.00	1.259	1.191	1.154	1.128	1.108	1.092	1.079	1.068	1.059	1.050
3.00	1.295	1.225	1.186	1.159	1.139	1.123	1.110	1.098	1.088	1.080
4.00	1.321	1.249	1.209	1.182	1.162	1.145	1.132	1.120	1.110	1.101
5.00	0.000	1.268	1.228	1.200	1.180	1.163	1.149	1.137	1.127	1.118
6.00	0.000	1.284	1.243	1.215	1.194	1.177	1.163	1.151	1.141	1.131
7.00	0.000	1.297	1.256	1.228	1.207	1.189	1.175	1.163	1.153	1.143
8.00	0.000	1.309	1.267	1.239	1.217	1.200	1.186	1.174	1.163	1.153
9.00	0.000	1.319	1.277	1.249	1.227	1.210	1.195	1.183	1.172	1.163
10.00	0.000	0.000	1.286	1.257	1.236	1.218	1.204	1.191	1.180	1.171
15.00	0.000	0.000	0.000	1.292	1.269	1.251	1.236	1.224	1.212	1.203
20.00	0.000	0.000	0.000	0.000	1.293	1.275	1.260	1.247	1.236	1.226

Cost Equations: EPA Secondary

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 95%

Borrowing Rate: Corporate: 9% Municipal: 7.5%

Table 4

Ratio of POTW to Self-Treatment Present Value Costs

PLANT LOAD	POTW LOAD (MGD)									
	5	10	15	20	25	30	35	40	45	50
0.25	1.442	1.364	1.321	1.291	1.269	1.251	1.236	1.223	1.212	1.202
0.50	1.499	1.418	1.373	1.342	1.319	1.300	1.285	1.272	1.260	1.250
0.75	1.533	1.450	1.404	1.373	1.349	1.330	1.314	1.300	1..289	1.278
1.00	1.558	1.473	1.427	1.395	1.371	1.351	1.335	1.321	1.209	1.299
2.00	1.618	1.530	1.482	1.449	1.423	1.403	1.387	1.372	1.360	1.349
3.00	1.654	1.564	1.515	1.481	1.455	1.434	1.417	1.403	1.390	1.379
4.00	1.680	1.589	1.538	1.504	1.478	1.457	1.439	1.425	1.412	1.400
5.00	0.000	1.608	1.557	1.522	1.495	1.474	1.457	1.442	1.429	1.417
6.00	0.000	1.623	1.572	1.537	1.510	1.489	1.471	1.456	1.443	1.431
7.00	0.000	1.637	1.585	1.549	1.522	1.501	1.483	1.468	1.454	1.443
8.00	0.000	1.648	1.596	1.560	1.533	1.512	1.494	1.478	1.465	1.453
9.00	0.000	1.659	1.606	1.570	1.543	1.521	1.503	1.487	1.474	1.462
10.00	0.000	0.000	1.615	1.579	1.552	1.530	1.511	1.496	1.482	1.470
15.00	0.000	0.000	0.000	1.613	1.585	1.563	1.544	1.528	1.514	1.502
20.00	0.000	0.000	0.000	0.000	1.609	1.586	1.567	1.551	1.537	1.525

Cost Equations: EPA Secondary

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 95%

Borrowing Rate: Corporate: 7.5% Municipal: 7.5%

Table 5
Ratio of POTW to Self-Treatment Present Value Costs

PLANT	POTW LOAD (MGD)									
LOAD	5	10	15	20	25	30	35	40	45	50
0.25	0.892	1.053	1.173	1.272	1.359	1.436	1.506	1.571	1.632	1.689
0.50	0.860	1.015	1.130	1.226	1.309	1.384	1.451	1.514	1.572	1.627
0.75	0.836	0.987	1.100	1.193	1.274	1.346	1.412	1.473	1.529	1.583
1.00	0.817	0.965	1.075	1.166	1.245	1.316	1.380	1.440	1.495	1.547
2.00	0.765	0.903	1.006	1.091	1.165	1.231	1.292	1.347	1.399	1.448
3.00	0.730	0.861	0.959	1.041	1.111	1.174	1.232	1.285	1.335	1.381
4.00	0.703	0.829	0.924	0.002	1.070	1.131	1.186	1.237	1.285	1.330
5.00	0.000	0.803	0.895	0.971	1.037	1.095	1.149	1.199	1.245	1.288
6.00	0.000	0.781	0.870	0.944	1.008	1.066	1.118	1.166	1.211	1.253
7.00	0.000	0.762	0.849	0.921	0.984	1.040	1.090	1.137	1.181	1.223
8.00	0.000	0.746	0.831	0.901	0.962	1.017	1.066	1.112	1.155	1.196
9.00	0.000	0.731	0.814	0.883	0.943	0.996	1.045	1.090	1.132	1.171
10.00	0.000	0.000	0.799	0.866	0.925	0.978	1.025	1.070	1.111	1.150
15.00	0.000	0.000	0.000	0.802	0.856	0.905	0.949	0.990	1.028	1.064
20.00	0.000	0.000	0.000	0.000	0.806	0.852	0.894	0.932	0.968	1.002

Cost Equations: EPA AWT

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 50%

Borrowing Rate: Corporate: 9% Municipal: 7.5%

Table 6

Ratio of POTW to Self-Treatment Present Value Costs

PLANT LOAD	POTW LOAD (MGD) 5	10	15	20	25	30	35	40	45	50
0.25	1.400	1.653	1.841	1.997	2.133	2.254	2.364	2.466	2.561	2.650
0.50	1.317	1.554	1.732	1.878	2.006	2.120	2.223	2.319	2.409	2.493
0.75	1.260	1.487	1.657	1.797	1.919	2.028	2.127	2.219	2.305	2.385
1.00	1.216	1.436	1.599	1.735	1.853	1.958	2.054	2.142	2.225	2.302
2.00	1.100	1.299	1.447	1.570	1.676	1.771	1.858	1.938	2.013	2.083
3.00	1.027	1.212	1.350	1.465	1.564	1.653	1.734	1.809	1.878	1.944
4.00	0.973	1.149	1.280	1.388	1.482	1.566	1.643	1.714	1.780	1.842
5.00	0.000	1.098	1.224	1.327	1.417	1.498	1.571	1.639	1.702	1.762
6.00	0.000	1.057	1.178	1.277	1.364	1.442	1.512	1.577	1.638	1.695
7.00	0.000	1.022	1.139	1.235	1.319	1.394	1.462	1.525	1.584	1.639
8.00	0.000	0.992	1.105	1.198	1.280	1.352	1.418	1.480	1.537	1.590
9.00	0.000	0.965	1.075	1.166	1.245	1.316	1.380	1.440	1.495	1.547
10.00	0.000	0.000	1.048	1.137	1.214	1.283	1.346	1.404	1.458	1.509
15.00	0.000	0.000	0.000	1.027	1.097	1.159	1.216	1.268	1.317	1.363
20.00	0.000	0.000	0.000	0.000	1.015	1.073	1.126	1.174	1.219	1.262

Cost Equations: EPA AWT

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 75%

Borrowing Rate: Corporate: 9% Municipal: 7.5%

Table 7

Ratio of POTW to Self-Treatment Present Value Costs

PLANT	POTW LOAD (MGD)									
LOAD	5	10	15	20	25	30	35	40	45	50
0.25	0.300	0.258	0.236	0.222	0.214	0.205	0.199	0.193	0.188	0.184
0.50	0.366	0.315	0.288	0.270	0.260	0.250	0.242	0.235	0.229	0.224
0.75	0.409	0.352	0.321	0.302	0.291	0.279	0.270	0.262	0.256	0.250
1.00	0.441	0.380	0.347	0.326	0.314	0.302	0.292	0.283	0.276	0.270
2.00	0.527	0.454	0.415	0.389	0.375	0.361	0.349	0.339	0.330	0.323
3.00	0.583	0.502	0.459	0.431	0.415	0.399	0.386	0.375	0.365	0.357
4.00	0.625	0.538	0.492	0.462	0.445	0.428	0.414	0.402	0.392	0.383
5.00	0.000	0.568	0.519	0.487	0.470	0.451	0.436	0.424	0.413	0.404
6.00	0.000	0.589	0.539	0.505	0.487	0.468	0.453	0.440	0.429	0.419
7.00	0.000	0.611	0.559	0.524	0.505	0.486	0.470	0.456	0.445	0.435
8.00	0.000	0.626	0.572	0.537	0.518	0.497	0.481	0.467	0.455	0.445
9.00	0.000	0.642	0.586	0.550	0.531	0.510	0.493	0.479	0.467	0.456
10.00	0.000	0.000	0.600	0.563	0.543	0.521	0.504	0.490	0.477	0.467
15.00	0.000	0.000	0.000	0.613	0.591	0.568	0.550	0.534	0.520	0.509
20.00	0.000	0.000	0.000	0.000	0.628	0.604	0.584	0.567	0.553	0.540

Cost Equations: CDM Secondary

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 50%

Borrowing Rate: Corporate: 9% Municipal: 7.5%

Table 8

Ratio of POTW to Self-Treatment Present Value Costs

PLANT	POTW LOAD (MGD)									
LOAD	5	10	15	20	25	30	35	40	45	50
0.25	0.391	0.337	0.308	0.289	0.278	0.267	0.259	0.251	0.245	0.239
0.50	0.486	0.418	0.382	0.359	0.346	0.332	0.321	0.312	0.304	0.297
0.75	0.549	0.472	0.432	0.405	0.391	0.375	0.363	0.353	0.344	0.336
1.00	0.597	0.514	0.469	0.441	0.425	0.408	0.395	0.383	0.374	0.365
2.00	0.725	0.624	0.570	0.535	0.516	0.496	0.480	0.466	0.454	0.444
3.00	0.809	0.696	0.636	0.597	0.576	0.553	0.535	0.520	0.507	0.495
4.00	0.872	0.751	0.686	0.644	0.621	0.597	0.577	0.561	0.546	0.534
5.00	0.000	0.796	0.727	0.682	0.658	0.632	0.611	0.594	0.597	0.566
6.00	0.000	0.826	0.755	0.708	0.683	0.656	0.635	0.616	0.601	0.587
7.00	0.000	0.859	0.785	0.737	0.710	0.683	0.660	0.641	0.625	0.611
8.00	0.000	0.879	0.803	0.754	0.727	0.698	0.675	0.656	0.639	0.625
9.00	0.000	0.902	0.824	0.774	0.746	0.717	0.693	0.673	0.656	0.641
10.00	0.000	0.000	0.844	0.792	0.764	0.734	0.709	0.689	0.672	0.657
15.00	0.000	0.000	0.000	0.866	0.835	0.802	0.775	0.753	0.734	0.718
20.00	0.000	0.000	0.000	0.000	0.889	0.854	0.826	0.802	0.782	0.764

Cost Equations: CDM Secondary

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 75%

Borrowing Rate: Corporate: 9% Municipal: 7.5%

Table 9

Ratio of POTW to Self-Treatment Present Value Costs

PLANT	POTW LOAD (MGD)									
LOAD	5	10	15	20	25	30	35	40	45	50
0.25	0.516	0.444	0.406	0.381	0.367	0.353	0.341	0.331	0.323	0.316
0.50	0.659	0.568	0.519	0.487	0.469	0.451	0.436	0.424	0.413	0.404
0.75	0.756	0.651	0.595	0.559	0.539	0.517	0.500	0.486	0.474	0.463
1.00	0.832	0.716	0.654	0.614	0.592	0.569	0.550	0.534	0.521	0.509
2.00	1.036	0.892	0.815	0.765	0.738	0.709	0.685	0.666	0.649	0.634
3.00	1.172	1.008	0.922	0.865	0.834	0.801	0.775	0.753	0.734	0.717
4.00	1.275	1.098	1.003	0.942	0.908	0.872	0.844	0.819	0.799	0.781
5.00	0.000	1.171	1.070	1.005	0.969	0.931	0.900	0.874	0.852	0.833
6.00	0.000	1.217	1.112	1.044	1.006	0.967	0.935	0.908	0.885	0.865
7.00	0.000	1.271	1.162	1.090	1.051	1.010	0.977	0.949	0.925	0.904
8.00	0.000	1.298	1.187	1.114	1.074	1.032	0.998	0.969	0.945	0.923
9.00	0.000	1.335	1.220	1.145	1.104	1.061	1.026	0.996	0.971	0.949
10.00	0.000	0.000	1.251	1.174	1.132	1.087	1.051	1.021	0.996	0.973
15.00	0.000	0.000	0.000	1.290	1.244	1.195	1.156	1.123	1.094	1.070
20.00	0.000	0.000	0.000	0.000	1.329	1.277	1.235	1.200	1.169	1.143

Cost Equations: CDM Secondary

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 95%

Borrowing Rate: Corporate: 9% Municipal: 7.5%

Table 10

Ratio of POTW to Self-Treatment Present Value Costs

PLANT	POTW LOAD (MGD)									
LOAD	5	10	15	20	25	30	35	40	45	50
0.25	0.608	0.523	0.478	0.449	0.433	0.416	0.402	0.390	0.381	0.372
0.50	0.793	0.683	0.624	0.586	0.565	0.543	0.525	0.510	0.497	0.486
0.75	0.922	0.793	0.725	0.681	0.656	0.630	0.610	0.592	0.577	0.564
1.00	1.022	0.880	0.804	0.755	0.728	0.699	0.676	0.657	0.640	0.626
2.00	1.300	1.119	1.023	0.960	0.926	0.889	0.860	0.835	0.814	0.796
3.00	1.488	1.281	1.170	1.098	1.059	1.018	0.984	0.956	0.932	0.911
4.00	1.633	1.405	1.284	1.205	1.162	1.117	1.080	1.049	1.022	0.999
5.00	0.000	1.508	1.378	1.294	1.247	1.199	1.159	1.126	1.097	1.073
6.00	0.000	1.569	1.434	1.346	1.297	1.247	1.205	1.171	1.141	1.116
7.00	0.000	1.646	1.504	1.412	1.361	1.308	1.264	1.228	1.197	1.170
8.00	0.000	1.678	1.534	1.440	1.388	1.334	1.290	1.253	1.221	1.194
9.00	0.000	1.728	1.579	1.482	1.429	1.373	1.328	1.290	1.257	1.229
10.00	0.000	0.000	1.621	1.522	1.467	1.410	1.363	1.324	1.291	1.261
15.00	0.000	0.000	0.000	1.680	1.620	1.557	1.505	1.462	1.425	1.393
20.000	0.000	0.000	0.000	0.000	1.737	1.669	1.614	1.568	1.528	1.494

Cost Equations: CDM Secondary

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 95%

Borrowing Rate: Corporate: 7.5% Municipal: 7.5%

Table 11

Ratio of POTW to Self-Treatment Present Value Costs

PLANT	POTW LOAD (MGD)									
LOAD	5	10	15	20	25	30	35	40	45	50
0.25	0.419	0.368	0.340	0.321	0.309	0.298	0.289	0.282	0.276	0.270
0.50	0.493	0.432	0.400	0.378	0.363	0.351	0.341	0.332	0.325	0.318
0.75	0.540	0.474	0.438	0.415	0.398	0.385	0.373	0.364	0.356	0.349
1.00	0.576	0.506	0.467	0.442	0.425	0.410	0.398	0.388	0.379	0.372
2.00	0.670	0.588	0.544	0.514	0.494	0.477	0.463	0.451	0.441	0.433
3.00	0.730	0.641	0.593	0.561	0.538	0.520	0.505	0.492	0.481	0.471
4.00	0.776	0.681	0.629	0.595	0.572	0.552	0.536	0.523	0.511	0.501
5.00	0.000	0.713	0.659	0.624	0.599	0.578	0.562	0.547	0.535	0.525
6.00	0.000	0.737	0.681	0.644	0.619	0.597	0.580	0.566	0.553	0.542
7.00	0.000	0.761	0.703	0.665	0.639	0.617	0.599	0.584	0.571	0.559
8.00	0.000	0.779	0.720	0.681	0.654	0.631	0.613	0.598	0.584	0.573
9.00	0.000	0.797	0.736	0.697	0.669	0.646	0.627	0.611	0.598	0.586
10.00	0.000	0.000	0.752	0.711	0.683	0.659	0.640	0.624	0.610	0.598
15.00	0.000	0.000	0.000	0.769	0.739	0.713	0.693	0.675	0.660	0.647
20.00	0.000	0.000	0.000	0.000	0.781	0.754	0.732	0.714	0.698	0.684

Cost Equations: CDM AWT

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 50%

Borrowing Rate: Corporate: 9% Municipal: 7.5%

Table 12

Ratio of POTW to Self-Treatment Present Value Costs

PLANT	POTW LOAD (MGD)									
LOAD	5	10	15	20	25	30	35	40	45	50
0.25	0.490	0.430	0.398	0.376	0.361	0.349	0.339	0.330	0.323	0.316
0.50	0.579	0.508	0.470	0.445	0.427	0.412	0.400	0.390	0.382	0.374
0.75	0.637	0.559	0.517	0.489	0.469	0.453	0.440	0.429	0.419	0.411
1.00	0.680	0.597	0.552	0.522	0.501	0.484	0.470	0.458	0.448	0.439
2.00	0.793	0.696	0.644	0.609	0.585	0.565	0.548	0.534	0.523	0.512
3.00	0.866	0.760	0.703	0.665	0.638	0.616	0.598	0.583	0.570	0.559
4.00	0.920	0.808	0.747	0.707	0.679	0.655	0.636	0.620	0.606	0.594
5.00	0.000	0.847	0.783	0.740	0.711	0.687	0.667	0.650	0.635	0.623
6.00	0.000	0.874	0.808	0.765	0.734	0.709	0.688	0.671	0.656	0.643
7.00	0.000	0.903	0.835	0.790	0.758	0.732	0.711	0.693	0.678	0.664
8.00	0.000	0.924	0.854	0.808	0.776	0.749	0.727	0.709	0.693	0.680
9.00	0.000	0.945	0.874	0.827	0.794	0.767	0.744	0.726	0.709	0.695
10.00	0.000	0.000	0.892	0.844	0.810	0.782	0.760	0.741	0.724	0.710
15.00	0.000	0.000	0.000	0.913	0.877	0.846	0.822	0.801	0.783	0.768
20.00	0.000	0.000	0.000	0.000	0.926	0.895	0.869	0.847	0.828	0.811

Cost Equations: CDM AWT

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 75%

Borrowing Rate: Corporate: 9% Municipal: 7.5%

Table 13

Ratio of POTW to Self-Treatment Present Value Costs

PLANT	POTW LOAD (MGD)									
LOAD	5	10	15	20	25	30	35	40	45	50
0.25	0.567	0.498	0.460	0.435	0.418	0.404	0.392	0.382	0.374	0.366
0.50	0.674	0.592	0.547	0.518	0.497	0.480	0.466	0.454	0.444	0.435
0.75	0.743	0.652	0.603	0.570	0.548	0.529	0.513	0.501	0.489	0.480
1.00	0.795	0.697	0.645	0.610	0.586	0.566	0.549	0.535	0.524	0.513
2.00	0.930	0.816	0.755	0.714	0.686	0.662	0.643	0.627	0.613	0.601
3.00	1.017	0.892	0.825	0.781	0.750	0.724	0.703	0.685	0.670	0.657
4.00	1.082	0.950	0.878	0.831	0.798	0.770	0.748	0.729	0.713	0.699
5.00	0.000	0.996	0.921	0.871	0.836	0.808	0.784	0.764	0.747	0.733
6.00	0.000	1.028	0.950	0.899	0.863	0.834	0.809	0.789	0.771	0.756
7.00	0.000	1.062	0.982	0.929	0.892	0.861	0.836	0.815	0.797	0.781
8.00	0.000	1.086	1.004	0.950	0.912	0.881	0.855	0.834	0.815	0.799
9.00	0.000	1.111	1.027	0.972	0.933	0.901	0.875	0.853	0.834	0.817
10.00	0.000	0.000	1.048	0.992	0.953	0.920	0.893	0.871	0.851	0.834
15.00	0.000	0.000	0.000	1.073	1.030	0.995	0.966	0.942	0.921	0.902
20.00	0.000	0.000	0.000	0.000	1.089	1.052	1.021	0.995	0.973	0.954

Cost Equations: CDM AWT

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 95%

Borrowing Rate: Corporate: 9% Municipal: 7.5%

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Table 14

Ratio of POTW to Self-Treatment Present Value Costs

PLANT LOAD	POTW LOAD (MGD) 5	10	15	20	25	30	35	40	45	50
0.25	0.613	0.538	0.497	0.471	0.452	0.436	0.424	0.413	0.404	0.396
0.50	0.731	0.642	0.593	0.561	0.539	0.520	0.505	0.492	0.482	0.472
0.75	0.807	0.708	0.655	0.619	0.595	0.574	0.558	0.544	0.531	0.521
1.00	0.864	0.758	0.701	0.663	0.637	0.615	0.597	0.582	0.569	0.558
2.00	1.013	0.889	0.822	0.778	0.747	0.721	0.700	0.682	0.667	0.654
3.00	1.108	0.973	0.899	0.851	0.817	0.789	0.766	0.747	0.730	0.716
4.00	1.180	1.036	0.958	0.906	0.870	0.840	0.816	0.795	0.777	0.762
5.00	0.000	1.087	1.005	0.950	0.913	0.881	0.856	0.834	0.816	0.799
6.00	0.000	1.121	1.036	0.981	0.942	0.909	0.883	0.861	0.841	0.825
7.00	0.000	1.158	1.071	1.013	0.973	0.940	0.912	0.889	0.870	0.852
8.00	0.000	1.184	1.095	1.036	0.995	0.961	0.933	0.909	0.889	0.871
9.00	0.000	1.212	1.120	1.060	1.018	0.983	0.954	0.930	0.910	0.891
10.00	0.000	0.000	1.144	1.082	1.039	1.003	0.974	0.950	0.928	0.910
15.00	0.000	0.000	0.000	1.170	1.124	1.085	1.054	1.027	1.004	0.984
20.00	0.000	0.000	0.000	0.000	1.188	1.147	1.114	1.085	1.061	1.040

Cost Equations: CDM AWT

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 95%

Borrowing Rate: Corporate: 7.5% Municipal: 7.5%

Table 15

Ratio of POTW to Self-Treatment Present Value Costs
No ICR Charge

PLANT	POTW LOAD (MGD)									
LOAD	5	10	15	20	25	30	35	40	45	50
0.25	0.787	0.752	0.733	0.719	0.709	0.701	0.694	0.688	0.683	0.679
0.50	0.827	0.790	0.770	0.756	0.745	0.737	0.730	0.723	0.718	0.713
0.75	0.851	0.813	0.792	0.778	0.767	0.758	0.751	0.744	0.739	0.734
1.00	0.868	0.830	0.809	0.794	0.783	0.773	0.766	0.760	0.754	0.749
2.00	0.911	0.871	0.848	0.833	0.821	0.812	0.804	0.797	0.791	0.786
3.00	0.937	0.895	0.872	0.856	0.844	0.834	0.826	0.819	0.813	0.808
4.00	0.955	0.913	0.889	0.873	0.861	0.851	0.843	0.836	0.829	0.824
5.00	0.000	0.927	0.903	0.887	0.874	0.864	0.856	0.848	0.842	0.837
6.00	0.000	0.938	0.914	0.897	0.885	0.875	0.866	0.859	0.852	0.847
7.00	0.000	0.948	0.924	0.907	0.894	0.884	0.875	0.868	0.861	0.856
8.00	0.000	0.957	0.932	0.915	0.902	0.892	0.883	0.876	0.869	9.863
9.00	0.000	0.964	0.939	0.922	0.909	0.899	0.890	0.882	0.876	0.870
10.00	0.000	0.000	0.946	0.929	0.916	0.905	0.896	0.889	0.882	0.876
15.00	0.000	0.000	0.000	0.954	0.940	0.930	0.921	0.913	0.906	0.900
20.00	0.000	0.000	0.000	0.000	0.958	0.947	0.938	0.930	0.923	0.917

Cost Equations: EPA Secondary

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 95%

Borrowing Rate: Corporate: 9% Municipal: 7.5%

Table 16

Ratio of POTW to Self-Treatment Present Value Costs
No ICR Charge

PLANT LOAD	POTW LOAD (MGD) 5	10	15	20	25	30	35	40	45	50
0.25	1.043	0.997	0.971	0.954	0.940	0.929	0.920	0.913	0.906	0.900
0.50	1.085	1.037	1.010	0.991	0.977	0.966	0.957	0.949	0.942	0.935
0.75	1.109	1.060	1.033	1.014	1.000	0.988	0.978	0.970	0.963	0.957
1.00	1.127	1.077	1.049	1.030	1.016	1.004	0.994	0.986	0.978	0.972
2.00	1.171	1.119	1.090	1.070	1.055	1.043	1.032	1.024	1.016	1.009
3.00	1.197	1.144	1.114	1.094	1.078	1.066	1.055	1.046	1.039	1.032
4.00	1.215	1.161	1.131	1.111	1.095	1.082	1.072	1.063	1.055	1.048
5.00	0.000	1.175	1.145	1.124	1.108	1.095	1.085	1.076	1.068	1.061
6.00	0.000	1.187	1.156	1.135	1.119	1.106	1.095	1.086	1.078	1.071
7.00	0.000	1.197	1.166	1.144	1.128	1.115	1.104	1.095	1.087	1.080
8.00	0.000	1.205	1.174	1.152	1.136	1.123	1.112	1.103	1.095	1.087
9.00	0.000	1.213	1.181	1.160	1.143	1.130	1.119	1.110	1.101	1.094
10.00	0.000	0.000	1.188	1.166	1.150	1.136	1.125	1.116	1.108	1.100
15.00	0.000	0.000	0.000	1.191	1.174	1.161	1.150	1.140	1.132	1.124
20.00	0.000	0.000	0.000	0.000	1.192	1.179	1.167	1.157	1.149	1.141

Cost Equations: EPA Secondary

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 95%

Borrowing Rate: Corporate: 7.5% Municipal: 7.5%

Table 17

Ratio of POTW to Self-Treatment Present Value Costs
No ICR Charge

PLANT	POTW LOAD (MGD)									
LOAD	5	10	15	20	25	30	35	40	45	50
0.25	0.658	0.820	0.941	1.041	1.128	1.206	1.277	1.342	1.403	1.460
0.50	0.634	0.791	0.907	1.004	1.087	1.162	1.230	1.293	1.351	1.407
0.75	0.617	0.769	0.882	0.976	1.058	1.130	1.197	1.258	1.315	1.368
1.00	0.603	0.752	0.863	0.954	1.034	1.105	1.170	1.230	1.285	1.338
2.00	0.564	0.704	0.807	0.893	0.968	1.034	1.095	1.151	1.203	1.252
3.00	0.538	0.671	0.770	0.852	0.923	0.986	1.044	1.097	1.147	1.194
4.00	0.518	0.646	0.741	0.820	0.889	0.950	1.005	1.057	1.105	1.150
5.00	0.000	0.626	0.718	0.795	0.861	0.920	0.974	1.024	1.070	1.114
6.00	0.000	0.609	0.699	0.773	0.837	0.895	0.947	0.996	1.041	1.083
7.00	0.000	0.594	0.682	0.754	0.817	0.873	0.924	0.971	1.015	1.057
8.00	0.000	0.581	0.667	0.737	0.799	0.854	0.904	0.950	0.993	1.034
9.00	0.000	0.569	0.653	0.723	0.783	0.837	0.886	0.931	0.973	1.013
10.00	0.000	0.000	0.641	0.709	0.768	0.821	0.869	0.914	0.955	0.994
15.00	0.000	0.000	0.000	0.656	0.711	0.760	0.804	0.845	0.884	0.920
20.00	0.000	0.000	0.000	0.000	0.669	0.716	0.757	0.796	0.832	0.866

Cost Equations: EPA AWT

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 50%

Borrowing Rate: Corporate: 9% Municipal: 7.5%

Table 18

Ratio of POTW to Self-Treatment Present Value Costs
No ICR Charge

PLANT	POTW LOAD (MGD)									
LOAD	5	10	15	20	25	30	35	40	45	50
0.25	1.033	1.288	1.478	1.635	1.771	1.893	2.004	2.106	2.201	2.291
0.50	0.971	1.211	1.390	1.537	1.665	1.780	1.884	1.981	2.070	2.155
0.75	0.929	1.159	1.330	1.471	1.594	1.703	1.803	1.895	1.981	2.062
1.00	0.897	1.119	1.284	1.420	1.538	1.644	1.740	1.829	1.912	1.990
2.00	0.812	1.012	1.161	1.285	1.392	1.488	1.575	1.655	1.730	1.801
3.00	0.757	0.945	1.084	1.199	1.299	1.388	1.470	1.545	1.615	1.681
4.00	0.718	0.895	1.027	1.136	1.231	1.315	1.393	1.464	1.530	1.592
5.00	0.000	0.856	0.982	1.086	1.177	1.258	1.332	1.400	1.463	1.523
6.00	0.000	0.824	0.945	1.046	1.133	1.211	1.282	1.347	1.408	1.465
7.00	0.000	0.796	0.914	1.011	1.095	1.170	1.239	1.302	1.361	1.417
8.00	0.000	0.773	0.887	0.981	1.063	1.136	1.202	1.264	1.321	1.375
9.00	0.000	0.752	0.863	0.954	1.034	1.105	1.170	1.229	1.285	1.338
10.00	0.000	0.000	0.841	0.931	1.008	1.078	1.141	1.199	1.253	1.304
15.00	0.000	0.000	0.000	0.841	0.911	0.973	1.030	1.083	1.132	1.178
20.00	0.000	0.000	0.000	0.000	0.843	0.901	0.954	1.003	1.048	1.091

Cost Equations: EPA AWT

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 75%

Borrowing Rate: Corporate: 9% Municipal: 7.5%

Table 19

Ratio of POTW to Self-Treatment Present Value Costs
No ICR Charge

PLANT LOAD	POTW LOAD (MGD) 5	10	15	20	25	30	35	40	45	50
0.25	0.367	0.314	0.285	0.267	0.258	0.248	0.239	0.232	0.226	0.220
0.50	0.469	0.401	0.365	0.341	0.330	0.316	0.305	0.296	0.288	0.282
0.75	0.538	0.460	0.419	0.392	0.379	0.363	0.350	0.340	0.331	0.323
1.00	0.592	0.506	0.460	0.431	0.416	0.399	0.385	0.374	0.364	0.355
2.00	0.737	0.631	0.573	0.536	0.519	0.497	0.480	0.466	0.453	0.443
3.00	0.834	0.713	0.648	0.607	0.586	0.562	0.543	0.527	0.513	0.501
4.00	0.908	0.776	0.706	0.660	0.638	0.612	0.591	0.573	0.558	0.545
5.00	0.000	0.828	0.753	0.704	0.681	0.653	0.630	0.611	0.595	0.581
6.00	0.000	0.860	0.782	0.732	0.708	0.679	0.655	0.635	0.619	0.604
7.00	0.000	0.899	0.817	0.765	0.739	0.709	0.684	0.664	0.646	0.631
8.00	0.000	0.918	0.835	0.781	0.755	0.724	0.699	0.678	0.660	0.645
9.00	0.000	0.944	0.858	0.803	0.776	0.744	0.719	0.697	0.679	0.663
10.00	0.000	0.000	0.880	0.823	0.796	0.763	0.737	0.715	0.696	0.679
15.00	0.000	0.000	0.000	0.905	0.875	0.839	0.810	0.785	0.765	0.747
20.00	0.000	0.000	0.000	0.000	0.935	0.896	0.865	0.839	0.817	0.798

Cost Equations: CDM Secondary

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 95%

Borrowing Rate: Corporate: 9% Municipal: 7.5%

Table 20

Ratio of POTW to Self-Treatment Present Value Costs

PLANT	POTW LOAD (MGD)									
LOAD	5	10	15	20	25	30	35	40	45	50
0.25	0.432	0.370	0.336	0.315	0.304	0.292	0.282	0.273	0.266	0.260
0.50	0.565	0.483	0.439	0.411	0.397	0.381	0.368	0.357	0.347	0.339
0.75	0.656	0.561	0.510	0.477	0.461	0.442	0.427	0.414	0.403	0.394
1.00	0.728	0.622	0.566	0.529	0.512	0.491	0.474	0.459	0.447	0.437
2.00	0.925	0.791	0.720	0.673	0.651	0.624	0.602	0.584	0.569	0.556
3.00	1.059	0.905	0.823	0.770	0.745	0.714	0.689	0.669	0.651	0.636
4.00	1.162	0.994	0.904	0.845	0.817	0.784	0.756	0.734	0.714	0.698
5.00	0.000	1.066	0.970	0.907	0.877	0.841	0.812	0.788	0.767	0.749
6.00	0.000	1.109	1.009	0.943	0.912	0.875	0.844	0.819	0.797	0.779
7.00	0.000	1.163	1.058	0.990	0.957	0.918	0.886	0.859	0.837	0.817
8.00	0.000	1.187	1.079	1.010	0.976	0.936	0.904	0.876	0.853	0.833
9.00	0.000	1.222	1.111	1.040	1.005	0.964	0.930	0.902	0.879	0.858
10.00	0.000	0.000	1.141	1.067	1.032	0.989	0.955	0.926	0.902	0.880
15.00	0.000	0.000	0.000	1.178	1.139	1.092	1.055	1.023	0.996	0.972
20.00	0.000	0.000	0.000	0.000	1.221	1.171	1.131	1.097	1.068	1.042

Cost Equations: CDM Secondary

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 95%

Borrowing Rate: Corporate: 7.5% Municipal: 7.5%

Table 21

Ratio of POTW to Self-Treatment Present Value Costs
No ICR Charge

PLANT	POTW LOAD (MGD)									
LOAD	5	10	15	20	25	30	35	40	45	50
0.25	0.494	0.434	0.401	0.379	0.365	0.352	0.342	0.333	0.326	0.319
0.50	0.587	0.516	0.477	0.451	0.433	0.418	0.406	0.396	0.387	0.380
0.75	0.647	0.568	0.525	0.497	0.477	0.461	0.448	0.436	0.427	0.418
1.00	0.692	0.608	0.562	0.532	0.511	0.493	0.479	0.467	0.456	0.447
2.00	0.810	0.711	0.658	0.622	0.598	0.577	0.560	0.546	0.534	0.524
3.00	0.885	0.778	0.719	0.680	0.653	0.631	0.613	0.597	0.584	0.572
4.00	0.942	0.827	0.765	0.724	0.695	0.671	0.652	0.636	0.621	0.609
5.00	0.000	0.868	0.802	0.759	0.729	0.704	0.684	0.667	0.652	0.639
6.00	0.000	0.896	0.828	0.783	0.753	0.727	0.706	0.688	0.673	0.659
7.00	0.000	0.925	0.855	0.809	0.777	0.751	0.729	0.711	0.695	0.681
8.00	0.000	0.946	0.875	0.828	0.795	0.768	0.746	0.727	0.711	0.697
9.00	0.000	0.968	0.895	0.847	0.814	0.786	0.763	0.744	0.727	0.713
10.00	0.000	0.000	0.914	0.864	0.830	0.802	0.779	0.759	0.742	0.728
15.00	0.000	0.000	0.000	0.935	0.898	0.867	0.842	0.821	0.803	0.787
20.00	0.000	0.000	0.000	0.000	0.949	0.917	0.890	0.868	0.849	9.832

Cost Equations: CDM AWT

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 95%

Borrowing Rate: Corporate: 9% Municipal: 7.5%

Exhibit III-3-1

Table 22

Ratio of POTW to Self-Treatment Present Value Costs
No ICR Charge

PLANT	POTW LOAD (MGD)									
LOAD	5	10	15	20	25	30	35	40	45	50
0.25	0.534	0.469	0.433	0.410	0.394	0.380	0.369	0.360	0.352	0.345
0.50	0.637	0.559	0.517	0.489	0.470	0.454	0.440	0.429	0.420	0.412
0.75	0.703	0.617	0.570	0.540	0.518	0.501	0.486	0.474	0.463	0.454
1.00	0.752	0.661	0.611	0.578	0.555	0.536	0.520	0.507	0.496	0.486
2.00	0.882	0.775	0.716	0.678	0.651	0.629	0.610	0.595	0.582	0.570
3.00	0.965	0.848	0.784	0.741	0.712	0.688	0.668	0.651	0.637	0.624
4.00	1.028	0.903	0.834	0.789	0.758	0.732	0.711	0.693	0.678	0.664
5.00	0.000	0.947	0.875	0.828	0.796	0.768	0.746	0.727	0.711	0.697
6.00	0.000	0.977	0.903	0.854	0.821	0.793	0.770	0.750	0.734	0.719
7.00	0.000	1.009	0.933	0.883	0.848	0.819	0.795	0.775	0.758	0.743
8.00	0.000	1.032	0.954	0.903	0.867	0.837	0.813	0.793	0.775	0.760
9.00	0.000	1.056	0.976	0.924	0.887	0.857	0.832	0.811	0.793	0.777
10.00	0.000	0.000	0.996	0.943	0.906	0.875	0.849	0.828	0.810	0.793
15.00	0.000	0.000	0.000	1.020	0.980	0.946	0.919	0.895	0.876	0.858
20.00	0.000	0.000	0.000	0.000	1.035	1.000	0.971	0.946	0.925	0.907

Cost Equations: CDM AWT

Life: 30 Years

Discount Rate: 12.5%

Debt Share of Financing: 95%

Borrowing Rate: Corporate: 7.5% Municipal: 7.5%

4. Summary of Findings

a. General Findings

As shown in the prevous two sections, ICR is not necessary in order to maintain sewage rate parity. The analysis shows that for some medium to large industries with compatible wastes it is cheaper to self-treat than to discharge to a POTW. In effect, there is a potential subsidy to industry because of the tax advantages of self-treatment. These tax advantages include:

- Accelerated depreciation (over a five year period for pollution control equipment).
- Investment tax credit for capital expenditures.
- The use of tax-free IDB's (industrial development bonds) to finance self-treatment facilities.

In regards to the issue of deterring excess capacity, it appears that ICR has had little effect.

POTWs are required to be built with enough capacity to serve existing domestic, commercial and industrial users, and to provide sufficient reserve capacity for projected growth during the 20-year planning period. The Agency has determined, based on analysis of the most cost-effective methods for construction of wastewater treatment facilities, that reserve capacity for such facilities normally should be approximately 20 to 40% of design capacity, with higher reserve capacity in areas of unusually high growth. Based on the survey of 227 wastewater treatment facilities from which the study team obtained data, the average POTW has about 32% reserve capacity, which is within the 20-40% range normally essential for cost-effective design. The cases where reserve capacity is considerably greater than 32% could result from high anticipated growth rates, slow schedules for hook-up of existing installations to sewers, or the other factors including, in some cases, design of excess capacity for industrial or population growth which is desired by not fully justified on the basis of cost-effectiveness planning requirements. ICR apparently imposes such a minimal cost burden that it has not been a factor in decisions on how much capacity should be planned in POTWs. User charges and charges for local debt service can be relatively high, however, during the time before anticipated growth and new hook-ups utilize reserve capacity in treatment plants and spread relatively fixed costs over a large number of users. These high initial charges have possibly been a factor in encouraging industrial water conservation. The higher user charges and debt service costs could cause industry to reduce flow even more than might be expected, and consequently, cause even higher sewage treatment costs to other users. Distribution of the initial costs of needed reserve capacity among present users can be a major local issue.

The findings related to the third issue, that of water conservation are not as clear. Of the industries surveyed, 176 of 200 responding attributed water conservation to higher water rates and to User Charges, not to ICR. ICR, as a percentage of water bill and User Charges, is not that significant at this time. ICR averages, on an annual basis, approximately 10-15% of total sewage costs for most industries. The apparent reduction in water usage by industry, if continued, could have an impact on the amount of future capacity required in wastewater treatment facilities.

Based on the best available estimates, the ICR revenue retained by all grantees (over 5,000 in total) would be an average of $24 million per year, when all POWTs funded under the authorization of P.L. 92-500 and P.L. 95-217 are in place. This amount, would not have any significant contribution toward the grantees' financial capability to meet the cost (when adjusted for inflation in the ensuing recovery period) for future expansion and upgrading of the wastewater treatment works.

As stated previously, the economic impact of ICR has not been significant to date.

ICR has not been in effect for more than a year or two, and most grantees have suspended ICR billings while the ICR moratorium is in effect (through June 30, 1979). The exceptions to the insignificance of ICR are those cases where there are seasonal users and/or advanced waste treatment (AWT). In the case of seasonal users, total sewage costs for industries have increased by a factor of as much as several times. In the case of AWT, the cost to industry is much greater, (by about 50% per gallon) as compared with secondary treatment.

The impact of ICR is generally not great (less than 15% of total sewage charges) with the exception of the two cases previously mentioned. (See the Sacramento Case Study, Section III-6 for a discussion of the possible impacts of UC/ICR).

The study team could find only a few scattered instances of plant closings due to increased sewage costs, and none attributable solely to ICR. In every case, there were other factors such as plant age which also affected the plant closing decision. The study team was not able to identify any significant impact by ICR to date on employment, plant closings, industrial growth, import/export balance, or local tax bases. (See the Los Banos Case Study, Chapter III.6 for a discussion of the significance of UC/ICR on plant closings.)

ICR rates appear to be higher in older cities, particularly in the northeast, and particularly in small to medium sized cities, and in agricultural communities. Most older cities have a physical plant that requires some rehabilitation, and construction costs tend to be higher in more heavily populated areas; therefore, ICR rates are also higher in older cities, since ICR rates are a function of construction cost. The same situation frequently occurs in agricultural communities, which construct wastewater treatment facilities designed to handle seasonal peak loads, and which have unused capacity for a significant portion of the year. (See the Sacramento Case Study, Chapter III.6, for the effects of ICR on seasonal users.)

The study was not able to differentiate the impact of ICR on small versus large businesses, because very few industrial plants were willing to disclose production or sales data. The industries receiving survey questionnaires were told that participation in the survey was voluntary, and that all data submitted was potentially subject to public scrutiny under the Freedom of Information Act. The study team told individual industries that it was not anticipated that data related to specific industrial establishments would appear in the report. Industries were also told that data that they were reluctant to allow competitors to obtain should not be provided to the study team. An insufficient number of industries provided sales or production data to allow any differentiation of ICR's impact on small versus large industries.

ICR does not appear to be cost-effective in producing discretionary revenue for local government, at least in most cities. The incremental cost to grantees to maintain and operate ICR (that is, the "eliminatable cost" above and beyond UC costs) is small (averaging about $15,000 per grantee per year), when compared to the total costs of sewage treatment, (averaging about $6.0 million per grantee per year). However, average ICR revenues per grantee per year are approximately $101,000, of which only $10,100 is retained for discretionary use by the grantee.

b. Findings With Respect to Congressman Roberts' Questions

On December 15, 1977, Congressman Roberts inserted in the Congressional Record nine questions related to User Charges and Industrial Cost Recovery (see Exhibit V-1-4, Volume III). The questions, and the study team's response to them, appear below. It should be noted that some of the questions require an examination of anticipated actions, an area that is difficult to analyze.

QUESTION

First (A) Whether the Industrial Cost Recovery program (ICR) discriminates against particular industries or industrial plants in different locations,

(B) And do small town businesses pay more than their urban counterparts?

(C) What is the combined impact on such industries of the user charge or ICR requirements?

FINDING

(A) ICR rates are different in different locations, and are a function of the cost of a wastewater treatment plant's rate methodology, basis of allocation, etc. Some industries (especially heavy water users and/or strong dischargers) pay proportionally more for ICR than other users. The cost equations described in Chapter II, Methodology are capable of suggesting answers to some questions about the ICR program related to inter-community rate parity and cost effectiveness. In particular, the capital cost estimates indicate that ICR payments based solely on the relationship between firm and POTW flow will result in lower per-gallon ICR payments to firms discharging into large POTW's. This conclusion is appropriate regardless of which of the two cost data sources (EPA or CDM) or treatment levels is examined, although it must be noted that the impact is slight in the case of EPA based AWT estimates, since there does not appear to be any economies of scale in AWT plants.

The exhibited scale economies have another implication: if the proposed imposition of ICR payments induces some firms to withdraw from a POTW and self-treat, the total capital outlays, both public and private, would exceed the outlays necessary to construct a single POTW capable of treating the total flow. For example, and using the EPA secondary treatment equation, assume that a 20 MGD POTW is proposed at a cost of $29,597,000.

Assume, further, that two industrial plants with flows of 1 MGD each decide not to tie-in but to self-treat with a capital outlay of $2,120,000 each. The resultant 18 MGD POTW would then have a cost of $26,976,000. The total capital expenditures, both public and private, would be $31,216,000 with the two plants out, or $1,619,000 more than if a single plant had been constructed. Had the two 1 MGD plants been four 15 MGD plants, the total outlays would have been $1,987,000 higher than if a single plant treated the entire flow.

(B) The combined impact of User Charge (UC) and Industrial Recovery (ICR) is greatest on seasonal users (for ICR), on industries paying for AWT (for UC and ICR) and in those cases where rates prior to UC/ICR were low due to treatment levels or promotional (declining block) rate structures.

QUESTION

Second (A) Whether the ICR program and resultant user charges cause some communities to charge much higher costs for wastewater treatment than other communities in the same geographical area? (Some communities have indicated that disparities in ICR and user charges affect employment opportunities.)

(B) Whether a mechanism should be provided whereby a community may lower its user and ICR charges to a level that is competitive with other communities in order to restore parity?

FINDING

(A) We have not been able to identify any pattern in such cases, based on the data supplied to us by EPA or grantees (See the Los Banos Case Study).

(B) If a community were to lower its UC rates to be competitive with other nearby communities, a source of funding would have to be identified to provide for UC revenue, if the wastewater treatment plant is to be self-sufficient for OM & R costs and to operate at design levels of discharge. If ICR rates were lowered the federal government would receive less revenue than anticipated. Reduction of either UC or ICR rates would require that legislative mechanisms be enacted.

QUESTION

Third Whether the ICR program drives industries out of municipal systems, the extent and the community impact?

FINDING

There have been only a few instances of this happening to date, because very few communities have implemented ICR. Based on tax law, and the assumption that in the long run industry will choose the least expensive sewage treatment option, ICR (particularly when coupled with pretreatment) could encourage industry to self-treat. This would result in proportional increase in user charge costs and (possibly) in debt service costs, for the remaining POTW customers.

QUESTION

Fourth (A) Whether the industries tying into municipal systems pay more or less for pollution control than direct dischargers?

FINDING

It appears that medium or large size industries using a POTW could pay more (over time) for wastewater treatment than do direct dischargers depending on the tax structure of the self-treatment alternative.

QUESTION

Fifth Whether the ICR program encourages conservation, the extent and the economic or environmental impact?

FINDING

ICR appears to have a role in encouraging conservation of water, but is an insignificant conservation factor to date, particularly relative to User Charges and water costs.

QUESTION

Sixth Whether the ICR program encourages cost effective solutions to water pollution problems?

FINDING

ICR appears to have had no noticeable effect on cost effective solutions to water pollution.

QUESTION

Seventh How much revenue will this program produce for Local, State and Federal governments, and to what use will or should these revenues be put?

FINDING

Based on assumed eventual EPA grants of $45 billion, it appears that total ICR revenues will amount to $1-2 billion over 30 years. The split of these revenues would be:

- federal government -- $.5-1.0 billion (50%), to Treasury
- state government -- none
- local government --
  - for capital costs related to wastewater and to offset ICR administrative costs -- $.4-.8 billion (40%)
  - for discretionary use -- $.1-.2 billion (10%)

This is considerably less than the $4.5-7.0 billion estimated in the 1972 legislative history. Possible reasons for the reduction include:

- liberalized definitions of "industry" by local governments
- self-treatment and/or pre-treatment
- exclusion for dry industries
- water conservation
- the 25,000 gpd floor implemented by P.L. 95-217

QUESTION

Eighth Determination of the administrative costs of this program, additional billing costs imposed, costs associated with the monitoring of industrial effluent for the purpose of calculating the ICR changes, ancillary benefits associated with the monitoring of industrial effluent, procedures necessary to take account of charges in the number of industries discharging into municipal plants, and the impact of seasonal or other changes in the characteristics and quantity of effluents discharged by individual industries?

FINDING

The incremental costs of administering ICR (assuming that a User Charge system will be maintained) is relatively small and amounts to less than $20,000 per grantee per year, based on the data available to us.

QUESTION

Ninth Whether small industires should be exempted from ICR? How should small be defined? Is there a reasonable floor that can be established for ICR based upon percentage flow?

FINDING

EPA has already excluded most industries discharging less than 25,000 gallons per day from ICR. We were unable to obtain sufficient data to reach a specific finding or conclusion related to the question.

c. Other Findings

During the course of the project, the study team made several findings which, although not directly related to the scope of work, are still of interest.

ICR is not generally understood by grantees or by industry. Many grantees appear to be developing ICR systems with only a partial understanding of legal or regulatory requirements. Both grantees and industries are often unable to distinguish between

User Charges and ICR, or between ICR and local debt service. The various applications and interpetations of very complex ICR legislation, regulations, and guidelines by EPA personnel and by consultants can have a significant, although often unintended, impact on the level of ICR charges paid by similar industries. This impact is caused to some extent by the varying bases used for allocation of capital costs by grantees. (See the Olympia Case Study, Chapter III.6 for discusssion of cost allocation methods).

Repeated efforts (both legislative and regulatory) have been made to make ICR simpler and more cost-effective. These effots have been particularly successful, but have resulted in a dilution of the intent behind ICR. An example of this is the statutory exemption from ICR for all discharges with less than the equivalent of 25,000 gallons per day of sanitary waste. In addition, the Standard Industrial Classifications (SIC's) chosen by EPA to define industry exclude some large water users from ICR while including others. Since ICR rates are a function of POTW cost, disparities in ICR rates are inherent in the concept of ICR.

ICR is complicated to administer for both grantees and for EPA, and will require complex control mechanisms to assure integrity. In order to administer ICR, considerable resources msut be allocated by EPA at Headquarters level and in the Regional Offices, by the state agency responsible for water quality, and by the grantee. Relatively few ICR systems have been implemented because of the moratorium allowed by P.L. 95-217, and because many POTWs fundered by P.L. 92-500 grants have not gone on line. To date, control procedures and mechanisms necessary to assure that the ICR regulations are enforced consistently have not been developed by EPA, and will have to be installed if ICR is continued after June 30, 1979. This would be a resource-intensive undertaking at all levels. Control procedures will be necessary to insure that grantees:

- correctly classify industrial users.
- calculate and charge the correct ICR amounts to individual industrial users.
- properly collect, account for, invest, and return ICR revenues to the U. S. Treasury through EPA.

EPA personnel, grantees, and industrial user all stressed that the law and related regulations are complex, difficult to understand, and hard to implement. In most cases, all groups felt that the amount of revenue generated ($101,000) annual average per grantee) did not justify the resources utilized.

Grantees frequently have limited information related to the determination of costs or to customer characteristics. Many grantees have accounting and budgeting systems which are unable to provide sound cost data needed for User Charge or ICR rate-setting. Most grantees have customer data bases that appear to be inadequate for the implementation of adequate monitoring and enforcement programs or pretreatment programs. Regardless of the decision on ICR, grantees will be required to upgrade their information on industrial users for user charge and for pretreatment.

The adoption of UC/ICR revenue systems has caused a major shift in grantee revenue sources. The study data indicates that, prior to adoption of UC/ICR systems, an average of about 55% of grantee wastewater revenues came from the residential sector, with 45% coming from the non-residential sector. Subsequent to adoption or UC/ICR systems, this ratio was reversed.

Industries and grantees uniformly expressed concern over the costs of pretreatment. Almost without exception, grantees expressed concern over the impact that the enforcement of pretreatment requirements might have on industrial participation in POTW's. Many industries expressed an intention to reserve a final judgement on self treatment until they could determine the impact of pretreatment.

5. Alternatives to ICR

The purpose of this section is to discuss the alternatives to ICR that were considered and presented for public discussion and comment during the study. Based on the finding that ICR was not accomplishing the intended goals of sewage rate parity, adequate facility sizing, water conservation, and self sufficiency, a series of sixteen alternatives to ICR was developed. The alternatives were presented for discussion and comment at the ten public meetings held in the ten EPA Regional Offices (see Exhibit V-1-6, Volume III, for the alternatives presented).

The alternatives were developed by the Coopers & Lybrand study team, by EPA Regional Office and Headquarters personnel, and by the ICR Advisory Group. Each of the alternatives were intended to address one or more of the following concepts:

- Reduce rate disparities - One of the major concerns voiced during the study was the fact that similar industries discharging to different treatment plants would be paying disparate ICR rates. Several of the alternatives provided for the development of a uniform ICR rate, to reduce these possible inequities.
- Increase local discretion - Several communities were concerned that the ICR regulations were too rigid and restrictive, leaving the grantee no flexibility. Alternatives were designed that would allow grantees the flexibility to apply the ICR regulations to meet the unique circumstances of local situations.
- Simplify administration - Both grantees and EPA Regional Offices are required to devote resources to the administration and monitoring of ICR. On the average, the current ICR regulations are not cost effective in generating revenue for local municipalities or the Federal government. Alternatives were presented that would reduce the complexity of ICR regulations and reduce the burden on grantees and EPA to monitor ICR.
- Limit excess capacity - As mentioned previously ICR was intended as a mechanism to reduce excess capacity. The study team could find little evidence that ICR was having any significant impact on facility planning. In order to increase industries' participation in facility planning, and promote efficient sizing of POTW's, several alternatives were provided that could help limit excesss capacity.
- Encourage industrial participation in POTW's - The simulation analysis performed shows that for certain medium to large industries with compatible wastes, the cost of self-treatment could be less than the costs associated with discharging to a POTW. If industry withdraws from POTW's, the analysis shows that more capital resources will be expended than would be expended if joint treatment were utilized. In order to limit the adverse effects of industry withdrawing from POTW's, alternatives were designed that encouraged industry to remain in POTW's. These alternatives included offering tax relief to off-set

ICR charges and reduce the economic advantage of self-treatment.

- Encourage water conservation - Again, as noted before, one of the Legislative goals of ICR was to promote water conservation. One alternative provided that all costs of providing sewage treatment (including local capital costs) be recovered proportionately from all users. This means that all sewage service costs would be included in a useage based fee. In theory this would cause all users to reduce water consumption by generally increasing the cost associated with sewage treatment.
- Produce a long-term funding mechanism for grantees to be self-sufficient for the future expansion and upgrading of their POTW.
- Obtain additional data - The final intention of all of the alternatives was to elicit public comments from everyone concerned with ICR. The hope was that the sixteen alternatives would stimulate conversation and thinking on ICR, and provide new alternatives or a combination of alternatives not previously considered (Exhibit V-1-10, Volume III, summarizes comments and new alternatives presented at the ten public meetings).

At the time these ICR alternatives were discussed it was stressed that they were not ranked in any order of preference and that the alternatives were not mutually exclusive. The conclusions presented by the study team are based on these sixteen alternatives and the information received during the ten public meetings.

III.6. CASE STUDIES

City of Ravenna
City Hall
Ravenna, Nebraska

Ravenna was selected as a case study to demonstrate the effects of UC/ICR on industries located in rural communities. The city is currently in the proces of designing and constructing a land application wastewater treatment facility to replace the system now in use. The new facility scheduled to be completed in 1979 will provide tertiary treatment. Design parameters for the POTW are:

Flow - 308,000 gpd
BOD - 1,444 lbs/day
SS - 660 lbs/day

Total project costs are estimated to be $520,000 with the grantee providing $39,000, the state $39,000, and EPA approximately $442,000.

Currently sewer system users, both residential and industrial pay $24.00 per year, generating approximately $15,000 in total revenue. Total costs associated with the current system are approximately $3,500 in operations and maintenance expenses, with the surplus deposited in the city's general fund.

Estimated annual costs for the new system are as follows:

OM&RCosts -	$29,200 (see Exhibit I)
Debt Service	3,670
Total	$32,870

Charges to system users will be as follows:

User Charges - Annual		
Residential -	$21,000	($2.93 per account per month - 600 estimated accounts)
Henningsen Foods -	4,217	
Ravenna Cheese	12,350	
Total	$37,567	

Industrial Cost Recovery - Annual		(Using a 30 year recovery period)
Henningsen Foods -	1,979	
Ravenna Cheese -	5,822	
Total	$7,801	

The charges described above are estimated charges based on estimated percentage use of total design capacity. Industry's total estimated use of the system is as follows:

	Henningsen Foods	Ravenna Cheese
Flow	17%	28%
BOD	6%	61%
SS	8%	36%

Summary

Since the new facilities are not yet completed and on line, there is no way to estimate the impact on employment or industrial activity in Ravenna. The dollar impacts will be significant, however, assuming the estmated charges are correct. User charges for Henningsen Foods and Ravenna Cheese will increase from $24 per year to $4,217 and $12,350 respectively. ICR charges will add an additional $7,801 per year: $1,979 for Henningsen Foods and $5,822 for Ravenna Cheese.

EXHIBIT I

ESTIMATED ANNUAL SYSTEM COSTS

Operations and Maintenance			
Labor -	Operator @ $8	$ 800	
	Operator @ $5	5,000	
	Clerk @ $4	800	
	Part-time @ $3	300	
Total		$ 7,480	
Maintenance -	Materials	850	
	Treatment	800	
	Outside Repairs	600	
	Chemicals	300	
	Irrigation System	1,050	
Total		3,600	
Utilities			
	Power	12,090	
	Phone	100	
	Standby Fuel	40	
Total		12,230	
Equipment -	Truck	1,140	
	Mower	200	
Total		1,340	
Supplies -	Paper	850	
	Postage	1,200	
Total		2,050	
Fees - Audit and Consulting			2,500
Total Operations and Maintenance			29,200
Debt Service			3,670
Total Costs			$32,870

Olympia Brewery
Olympia, Washington

Introduction

This case study is designed to present an alternative method of determining the amount of industrial cost recovery to be paid by one industry. The information in this case study is based on a methodology developed by the Olympia Brewing Co. and is included here because the alternative appears reasonable and merits consideration. This methodology represents an incremental cost approach to determining industry's share of ICR.

There are currently two approvable methods for distributing ICR costs:

- Flow only method-used when all classes of users, including industry, discharge waste equivalent to domestic sewage. Total grant funds are divided by total design flow to compute a unit ICR rate.
- Proportionate allocation - industry's ICR charge is computed by multiplying the total grant funds allocated to flow, BOD, SS, or other parameters, by industry's proportionate contribution to each parameter.

Both of these methods will be compared to the incremental cost approach.

Flow Only Allocation

The easiest allocation to apply is the flow only allocation. If all classes of user discharge basically the same strength waste, ICR costs can be allocated based on the flow parameter only. (Table 1 and 2 summarize design parameters and grant funds assigned to each parameter). Assuming total grant funding of $22,395,266 a flow only allocation results in total ICR payments of $3,222,340, computed as follows:

$$\frac{\text{industrial flow}}{\text{total design}} \times \text{Total Grant Funding} =$$

$$\frac{2}{13.9} \times 22{,}395{,}266 = 3{,}222{,}340$$

Proportionate Allocation

Proportionate allocations are the most common ICR allocations and are used to determine industry's ICR payment when there are excess strength users on the system. Proportionate allocations would be computed as follows:

$$\frac{\text{Industrial Flow}}{\text{Design Flow}} \times \text{Grant Allocated to Flow} + \frac{\text{Industrial BOD}}{\text{Design BOD}} \times \text{Grant Allocated to BOD}$$

$$+ \frac{\text{Industrial SS}}{\text{Design SS}} \times \text{Grant Allocated to SS} = \text{Total ICR}$$

$$\frac{2}{13.9} \times 7{,}435{,}229 + \frac{18{,}000}{30.300} \times 8{,}599{,}782 +$$

$$\frac{3{,}300}{15{,}600} \times 6{,}360{,}255 = 7{,}524{,}037$$

Incremental Allocation

Stated quite simply, the incremental cost allocation makes the assumption that excess strength dischargers should pay the total cost of treatment works components that are needed to provide treatment for the wastes in excess of domestic strength sewage. Once the excess strength components are identified, all other treatment plant components are allocated on a flow only basis. This method allows industry to benefit from economies of scale.

If all users discharged domestic strength wastes the ICR calculation would be made on a flow only basis. Once those components necessary to treat excess strength discharges are identified and segregated, the remaining treatment plant components can be allocated on a flow only basis. In this case industry would pay 100% of the cost of components to treat BOD is excess of domestic strength; these components total $2,021,658. Remaining grant funds would be allocated on a flow only basis, as shown in Table 2 for a total of $4,953,113.

Summary

The basic advantage to an incremental cost approach is that it allows industry to take advantage of economies of scale when determining ICR cost allocations.

Table 1

POTW DESIGN PARAMETERS

LOADING	POTW DESIGN LOAD		DOMESTIC LOAD PORTION			INDUSTRIAL LOAD PORTION		
PARAMETER	TOTAL	CONCENTRATION	TOTAL	% OF TOTAL	CONCENTRATION	TOTAL	% OF TOTAL	CONCENTRATION
Flow, MGD	13.9	-	11.9	85.6	-	2	14.4	-
BOD #1 day	30,300	261 mgld	12,300	40.6	124 mgld	18,000	59.4	1080 mgld
SS #1 day	15,600	135 mgld	12,300	78.8	124 mgld	3,300	21.2	198 mgld

Table 2

COMPARISON OF ALTERNATIVE ICR COST ALLOCATION METHODS

PROPORTIONATE

ELIGIBLE PROJECT COSTS		GRANT FUNDING	ICR ALLOCATION
Flow	9,913,638	7,435,229	1,069,817
BOD	11,466,376	8,599,782	5,108,781
SS	8,480,340	6,360,255	1,345,439
Total	29,860,354	22,395,266	7,524,037

FLOW ONLY

COST ALLOCATION	29,860,354	22,395,266	3,222,340

INCREMENTAL

Flow	9,913,638	7,435,229	1,069,816
BOD-Normal	8,770,832	6,578,124	946,493
BOD-Excess	2,695,544	2,021,658	2,021,658
SS	8,480,340	6,360,255	915,145
Total	29,860,354	22,395,266	4,953,113

Sacramento Regional Country Sanitation District (SRCSD)
9660 Ecology Lane
Sacramento, California

SRCSD was selected as a case study because the District depicts in detail the typical history of user fee rate development and the possible future impacts of UC/ICR on industrial users and others. SRCSD provides wastewater conveyance, treatment, and disposal for the Cities of Sacramento and Folsome and the large unincorporated urban area of Sacramento County. Wastewater collection is provided by the Cities and the recently formed County Sanitation District No. 1. Table I provides a general description of the SRCSD treatment works that will go on line during fiscal year 1981.

User fee rate setting methodologies nationwide have gone through three basic periods in the last ten years. The first period, prior to passage of P.L. 92-500, saw grantees using a variety of rate mechanisms. In general most communities did not allocate system costs to users in proportion to the users' wasteload contribution to the system during this period. In many cases the industrial user class was undercharged and other user classes overcharged in relation to actual flows and loadings.

The second period, corresponding to the passage of P.L. 92-500 and extending to the present, is characterized by a shift towards proportionate rate methodologies, with all users paying for system costs in relation to their wastewater discharge to the treatment works. Although P.L. 92-500 only required that recipients of grant funds recover operations, maintenance, and replacement costs proportionately, approximately 70% of the grantees interviewed during the study recover all costs, including debt service, proportionately.

The third rate setting period, extending from the present into the indefinite future is characterized by a proportionate user charge system coupled with an industrial cost recovey system, recovering the portion of grant funds allocable to industry's share of the treatment works. Although many grantees have already developed ICR rates, relatively few have implemented the charges due to the ICR moratorium allowed in P.L. 95-217. A characteristic of all three periods is escalating system costs.

Rate setting in the Sacramento area has followed the pattern described above. Prior to FY 1975, rates did not require a proportionate allocation of costs and industry was undercharged in relation to toal flows and loadings contributed. Beginning with FY 75 phased rates were established requiring proportionate allocations of all costs including debt service to all user classes, with fully proportionate rates established in FY 77. The third period, (user charge and ICR) is expected to begin in FY 81 when the new regional facilities go on line. Table 2 depicts the UC/ICR rates to be implemented in FY 81. Table 3 shows average system costs for the three periods and the charges to the six largest industrial users for the same period. FY 81 costs are average costs for a three year period, and are presented with and without ICR charges. This table vividly portrays the dollar impact of UC/ICR on industry in Sacramento. From FY 74 to F7 81 there has been a 214% increase in total system costs. During the same period, charges to the largest six industrial users have experienced a 696% increase. Because of these large increases, two of Sacramento's largest industrial users are seriously considering withdrawing from the POTW and building their own land application systems. SRCSD estimates that if these two large users leave the system, costs to all users remaining with the POTW will increase by at least 11%.

Both representatives of SRCSD and the members of the Industrial Committee of the Scaramento Chamber of Commerce agree on the impacts of ICR on the community:

1. "Absent ICR and with an equitable allocation of costs for sewer service, the cost to some major elements of our local-industries is marginally above their costs for alternative remote disposal."
2. With the inclusion of a requirement for ICR, industry's costs will be higher by staying within the municipal system than they would be for separate disposal, and some of our industrial customers will either relocate their plants or convey the wastes to disposal sites at the urban margin."

Creation of additional disposal sites is in direct contradiction to the basic concept of the regional plan, which was to eliminate multiple disposal sites.

Industry points out that they have been heavily involved in all phases of the new facilities including planning and design. The Industrial Committee elected to participate in the regional program, despite apparent significant cost differences in alternative regional plans. At the time of site selection, none of the industries in Sacramento proposed to provide separate disposal. The cost advantage described above for separate disposal does not reflect optimum cost savings that could have been achieved, had separate disposal been considered at the time of site selection in 1973, using current estimates of costs shown in Table 3.

Summary

Sacramento is an example of a community that has had active involvement of industry in all phases of the design and construction of the treatment works. Based on costs presented at the time of site selection when the regional plan was finalized, none of the major industries intended to provide separate wastewater disposal. However, with current estimates of costs:

- Sewer service costs, without ICR, are marginally higher for some major local industries.
- With ICR, industry's costs will be significantly higher, by approximately $1.1 million annually.
- With ICR, those industries that are not geographically precluded from developing alternate disposal systems may likely withdraw from the POTW.
- The loss of these major industries will increase the costs to all users remaining on the sytem by 11%.
- The purpose of regionalization, to elimate multiple disposal sites, will be defeated as industries go to self-treatment.

The effects of ICR noted in Sacramento can be considered typical and will be recreated in other areas as the combined impacts of UC/ICR become apparent. In those cases where industries are not able to develop alternatives to discharging to the POTW because they are not situated on a receiving body of water or land application is not feasible, costs of wastewater disposal will become a significant factor in future decisions concerning plant expansion or relocation. Medium to large industries with compatible wastes will tend to locate in those areas where self-treatment is possible.

Table 1

Design Capacity:

Parameter	Seasonal	Non-Seasonal
Flow (MGD)	136	115
BOD (thousand #/day)	248	184
SS (thousand #/day)	239	175

The Sacramento Regional Wastewater Management Program consists of interim improvements to existing treatment plants, a system of interceptors and pumping stations, SRWTP, and the Combined Wastewater Control System (CWCS). Total capital costs of the program are $423 million of which $341 million is being financed from State and Federal grants. The remaining $82 million is the District's responsibility. Upon start-up of SRWTP in 1980, wastewater treatment in 22 separate treatment plants will be treated at the Sacramento Regional Wastewater Treatment Plant (SRWTP). SRWTP will provide secondary treatment using biological treatment with chemical coagulation. Approximately 90% of the design flow capacity will be utilized when the facilities go on line.

In 1981, the District will provide sewage service to approximately 725,000 residents of Sacramento County. Wastewater is discharged to the Regional system by various user groups including industrial, federal facilities, commercial, and residential. The percentage of the total annual volume of wastewater discharged by each major user group is shown below:

User Class	Total Annual Volume (percent)
Residential	75
Commercial	13
Industrial	11
Federal Facilities	1

Table 2

User Charge Rages

Operations, Maintenance
and Replacement rates

$.17	per thousand gallons
.024	per pound SS
.050	per pound BOD

Capital Cost Rates *

$8.41	per thousand gallons
.83	per pound SS
2.80	per pound BOD
.258	per $100 assessed value

ICR Rate *

$14.77	per thousand gallons
1.41	per pound SS
4.69	per pound BOD

* allocated on a demand basis including maximum monthly flow, BOD and SS.

Table 3

System Costs
($1,000)

	FY 74	FY 77	FY 81*	FY 81**
Operations, Maintenance, and Replacement	$6,320	$12,980	$14,551	$14,551
Debt Service	1,039	6,745	7,429	7,429
ICR				1,137
Total	7,359	19,725	21,980	23,117

Costs to Large Users
($1,000)

Campbell Soup	$153	$ 646	$1,097	$1,482
Proctor & Gamble	16	95	169	224
Keyes Fibre	34	76	163	198
Sacramento Foods	65	111	264	471
Libbey. McNeil, Libbey	78	75	177	307
Del Monte	50	151	290	471
Total	$396	$1,154	$2,160	$3,153

* without ICR

** with ICR

Sanitary District of Rockford
3333 Kishwaukee Street
P.O. Box 918
Rockford, IL 61105

Design Capacity	60,000,000	gpd
	85,400	lbs/day B.O.D.
	124,400	lbs/day S.S.

Secondary treatment level utilizing an activated sludge process (including nitrification) results from the EPA grant.

User Charge Rates

Flow $.1197/1,000 gallons
B.O.D. $.0293/lb.
S.S. $.1780/lb.

$68.45 per quarter per toxic to be monitored
$.0243 per pound of adjusted toxic loading

Annual Industrial Cost Recovery Rates
Estimated for projects completed through 1979 are below. Rates will increase as more projects are completed.

Flow $.029957 per 100 cubic feet
B.O.D. $.001035 per pound
S.S. $.004427 per pound

Total cost to upgrade/expand

$45,250,000

The Sanitary District of Rockford (SDR) was selected as a case study because of the high administrative and monitoring costs for the size of the facility. The SDR developed the user charge system in compliance with requirements of P.L. 92-500 during 1975 and implemented the system in April of 1976. Prior to the development of this system, the revenue for operation and maintenance of the district was derived from ad valorem taxes. The initiation of a user charge eliminated the financial problem of operating the district on a limited tax revenue base. However, the transfer to a user charge operation had a significant cost increase. This document will deal mainly with the increased costs incurred and not with the merits of the user charge system.

The main area of increased costs has been in increased personnel. In 1974, prior to the development of the user charge system, the district employed 75 employees. Last year, the staff increased to 115 full time employees. Approximately 75% of this increase is directly attributable to the administrative requirements of the user charge system. Major factors causing the increased costs include:

- The district bills approximately 45,000 users once each quarter on a cyclical basis. A service bureau was originally employed to handle this work. However, after a year of operation, it was found to be more efficient and cost effective to develop an in house computer department. This computer system required capital purchases of approximately $250,000 and also accounts for 5 of the additional personnel of the district.
- Because no appropriate data base was available, the district undertook an original survey of land use that took approximately 9 months to complete and cost $150,000 in order to determine who should be billed.
- Water usage information has to be obtained from three local water departments at an annual cost of approximately $50,000.
- In order to bill users on a proportional basis, required by P.L. 92-500 and particularly insisted upon by local industry, it was necessary to develop a sampling program to determine waste characteristics. The district had to purchase samplers and laboratory equipment at a cost in excess of

$100,000. Additional staff was required in the laboratory plus an entire department was created to handle waste surveillance.

- Collection problems, which previously were non--existant under the tax base, have created considerable expense and effort. The major problem facing a utility such as the district is an appropriate method to insure payment by all users. The district is still searching for the most effective means of overcoming this problem.

- Legal expenses have risen over the past three years also. This has been partially in connection with the collection problem. However, there have been several cases that dealt directly with the user charge system itself. This litigation has been not only expensive, but time consuming for the district.

- Other administration personnel who previously were concerned mainly with the operation of the treatment plant have now become involved with individual accounts, particularly industrial and commercial accounts. Although these accounts number only 3,100 of the 45,00 accounts, they represent 56% of the district's flow and therefore in many cases require a more complex recordkeeping system to maintain proper waste characteristic data on file.

- Another problem encountered was the high profile of the district in the community. When the users of the system were paying for district services on their tax bill, the public contacts for the district consisted of sewer backups and a few industrial contacts regarding toxic waste disposal. The district now receives from 20 to 50 calls daily concerning their user charge bills. The telephone system had to be expanded and a customer service clerk had to be hired to handle the user billing problem.

- Increased staff and increased record requirements have also caused expansion of the district's physical facilities. In 1976 the district completed an addition to its administration building. Another addition to house the computer facilities as well as expanded laboratory and sampling facilities is currently in the design stage. The original addition cost approximately $250,000 and the new addition is estimated to be about the same, for a total cost of $500,000.

In conclusion, although a user charge system should provide sufficient revenue for the operation of the district, and will bill users in proportion to their use of the facilities of the district, it should also be noted that a user charge system can be expensive to develop and will continue to cost the district significantly more to administer than the ad valorem system it replaced.

An important element that contributed to the increased cost for SDR, which cannot be accurately estimated, is the administrative costs that were caused by the agressive attitude of local civic and industrial groups in challenging SDR and the user charge and industrial cost recovery requirements.

City of Fall River
1 Government Center
Fall River, MA 02722

Design Capacity of new plant	30,900,000	gpd
	61,800	lbs/day B.O.D.
	46,740	lbs/day S.S.

Present treatment facility is overloaded. New plant, to be completed in 1981, is expected to be utilized at 75% of design capacity when it begins operation.

Secondary treatment level utilizing an activated sludge process using oxygen will result from the EPA grant.

Annual User Charge Rates

$12.00 per 1,000 gallon of average daily flow
$4.87 per average daily pound of B.O.D.
15.66 per average daily pound of S.S.

OR

Unit User Charge Rates

Assuming the daily averages apply for 365 days, the calculated unit UC rates are:

$.033/1,000 gal flow

$.013 per pound of B.O.D.

$.043 per pound of S.S.

Annual Industrial Cost Recovery Rates

Flow	$15.17 per 1,000 GPD
B.O.D.	$3.06 per average daily pound
S.S.	$3.52 per average daily pound

Total cost to upgrade/expand

$43,374,000

Fall River was selected as a case study for the following reasons:

- Industrialized city in the north east
- Significant textile industry in area
- Local industry appears to be only marginally profitable and the imposition of ICR may have a significant impact.
- Cooperation between local government and industry in opposition to ICR.

Fall River is an older, industrialized city. Local industries are competing against other areas with lower utility costs, lower taxes and better transportation costs. Because of the substantial upgrading of wastewater treatment facilities and the change from an ad valorem tax to a proportionate user charge basis, received total wastewater costs will increase significantly. The recurring statement from industries, local government and trade groups is that wastewater treatment costs will be the final incremental cost that will force them out of business in the Fall River area.

During the course of the C&L project, Fall River officials demonstrated the local opposition to UC and ICR. Illustrations of the opposition included the following:

- When the C&L consultant visited Fall River on July 27, 1978, to collect grantee information, the city scheduled a public meeting so that local industries could express their opposition to ICR. Approximately twenty people attended the meeting.

- Local industries kept Congresswoman Heckler informed of the study.
- At the request of local industries, a second public meeting to discuss UC and ICR and the objective of the C&L economic study was held on August 21, 1978. Approximately 30 people attended the meeting, including, the City's U. S. Representative (Mrs. Margaret Heckler, R.-Mass.). The recurring position was the opposition to ICR. A transcript of the August 21st meeting appear in Volume VII of this report.
- Representatives of the city and industries attended the October 24, 1978 Boston public meeting to express opposition to ICR.
- Representative Heckler also attended the Boston meeting, and spoke out forcefully against ICR.

The Fall River activities illustrate a coordinated effort to present a wide range of support for a specific issue - opposition to ICR.

Fall River is an area where the local economy may be seriously harmed by the imposition of user charge (UC) and industrial cost recovery (ICR) rates. A more detailed economic analysis of the impact of UC and ICR on the local economy should be conducted.

Portland Water District
Box 3553
332 Douglas St.
Portland, ME 04104

Design Capacity	15,000,000	gpd
	24,270	lbs/day B.O.D.
	28,760	lbs/day S.S.

Treatment facility was not in operation when survey was conducted. 75% of design capacity is expected to be utilized when the facility begins operation.

Secondary treatment level utilizing an activated sludge process (no nitrification) will result from the EPA grant.

User Charge Rates

		South Portland	Portland	Westbrook
Capital -	Flow	$54/1000 gal/day/Yr.		
	BOD	$ 4.65/lb/day/Yr.		
	SS	$ 4.83/lb/day/Yr.		
O&M	Flow	$ 0.40/1000 gal.		
	BOD	$ 0.1025/lb.		
	SS	$ 0.115/lb.		
Regular Rate			$1.12/100 cf	$ 0.75/100 cf
Surcharg	BOD		$0.056/lb over 250 mg/l	$89.17/1000 lb/. over 400 mg/l
	SS		$0.028/lb over 300 mg/l	$63.80/1000 lb. over 400 mg/l

Annual Industrial Cost Recovery Rate

	South Portland	Portland	Westbrook
ICR - Rate			
Flow	$47.27/1000 gal/day/Yr.		
BOD	$ 5.93/lb/day/Yr.		
SS	7.87/lb/day/Yr.		
Flow		$156/MG/Yr.	$76.36/MG/Yr.
BOD		$0.021/lb/Yr.	$0.032/lb/Yr.
SS		$0.014/lb/Yr.	$0.023/lb.Yr.

Total cost to upgrade/expand
$69,625,000

The Portland Water District was selected for a case study for the following reasons:

- Cooperation between local officials and industries in opposition in ICR.
- Illustration of wastewater cost disparities in a limited geographic area.

In July, 1978, when the Portland Water District was contacted to schedule a visit for completing the grantee survey form, the Chamber of Commerce of the Greater Portland Region scheduled a public meeting to "discuss the impact of industrial cost recovery and sewer use charges on your operations". Approximately 30 people attended the 8/1/78 meeting to discuss the significant cost increases, the effect of these higher costs on their ability to compete with other domestic and foreign companies and the disparity of costs within the Greater Portland Area.

Representatives from the Greater Portland area also attended the public meetings in Boston on 10/25/78 and 10/26/78 to express their concerns.

The Portland Water District (PWD) is a regional facility that serves several municipalities. While the charges levied by PWD are uniform for any municipality, because of varying municipal operations, costs to upgrade, methods of funding and development of billing systems, the cost for similar wastewater flows can vary significantly from one municipality to another. The rates listed previously for South Portland, Portland and Westbrook illustrate the difficulty in comparing areas - different computations and units are used. A simpler comparison is to take an assumed wastewater flow and calculate the charges that would result in each of the three cities. When an assumed flow of 144,000 gpd for 230 days per year with B.O.D. of 800 mg/l and S.S. of 2000 mg/l, the annual charges summarized below result.

	South Portland	Portland	Westbrook
Annual Industrial Cost Recovery			
Flow	$ 6,806.88	$ 5,166.72	$ 2,528.38
BOD	$ 5,692.80	$ 4,640.50	$ 7,071,23
SS	$ 18,903.74	$ 7,734,17	$12,706.14
TOTAL - ICR	$ 31,403.42	$17,541.39	$22,305.75
Annual User Charge			
Regular Rate	$ 21.031,20	$49,591.00	$33,208.56
Surcharge BOD	$ 27,114.04	$ 8,507.60	$ 9,852.22
SS	$ 75,132.38	$13,148.11	$28,196.60
TOTAL - UC	$123,277.62	$71,246.71	$71,257.38
Total Annual Cost	$154,681.04	$88,788.10	$93,563.13

Variations of this magnitude could affect relocation and self-treatment decisions for the affected industries.

Comparison of these alternative watewater costs can also be misleading because of the alternative methods that are acceptable for collecting the local share of capital costs and all annual operating costs except operations and maintenance. Any area comparisons must include all costs and sources of revenue.

City of Grand Rapids
Michigan 49502

Design Capacity	66,000,000	gpd
	61,100	lbs/day B.O.D.
	76,500	lbs/day S.S.
	4,240	lbs/day phosphoros

74% of design capacity presently used

Secondary treatment level utilizing an activated sludge process (including nitrification) results from the EPA grant.

User Charge Rates

Flow	$172.62/million gal
B.O.D.	$.04 per pound in excess of 300 mg/l
S.S.	$.04 per pound in excess of 350 mg/l

Annual Industrial Cost Recovery Rates

Flow	$.0162 per 100 cubic feet
B.O.D.	$.992 per 1000 lbs in excess of 300 mg/l
S.S.	$.721 per 1000 lbs in excess of 350 mg/l.

The City of Grand Rapids was selected as a case study because of the local benefits obtained through the meeting of EPA requirements for user charges (UC) and industrial cost recovery (ICR) systems.

The City provides water and sewer services to residents within the City and to adjacent suburban communities. Both water and sewer rates had been arbitrarily established and periodically increased to compensate for rising costs. In 1975, the need for an additional rate increase was coupled with the EPA requirement to develop UC and ICR systems. The City decided that an overall review of both the water and sewer use rate structures should be conducted. The three main objectives of the rate study were to:

- convince all users (city or suburban; residential or industrial) that the rates were equitable and fair.
- provide adequate revenue for water and sewer utilities.
- meet EPA requirements for UC and ICR.

In effect, the goal was to "take rate making out of politics".

The City's approach to rate making centered on the following elements.

- a 5 member steering committee representing expertise in finance, law, sewer use and sewage disposal, water and engineering. The steering committee was responsible for all decision recommendations.

- a public utility consultant to develop a work plan, advise the committee and suggest opinions. The consultant was not to make recommendations.
- a liaison committee consisting of 16 representatives from the suburban communities, the board of education, industrial customers, commercial customers and citizens. The liaison committee's major responsibility was to follow the actions of the steering committee and communicate with the groups they represented.
- news media participation to provide public awareness of the project and promote the policy of openness and public participation.

The three major objectives were accomplished: users agreed that rates were equitable; adequate revenue was assured; and the EPA approved UC and ICR systems. Additional benefits resulting from the project were:

- the greater participation of suburban communities in planning for growth and in deciding how to fund the growth
- resolution of disputes in rate contracts with suburban communities and industrial customers
- training of City personnel
- establishment of records and data

The key to the success of the project can be summarized as the active, informed participation of all affected parties in all of the decisions.

Metropolitan Waste Control Commission
350 Metro Square Building
Saint Paul, Minnesota 55101

Design Capacity	348,000,000	gpd
	778,000	lbs/day B.O.D.
	936,000	lbs/day S.S.

72% of design capacity is currently utilized

the 18 treatment plants provide secondary level of treatment, with primarily an activated sludge process.

User Charge Rates

$.270/1000 gal flow
$.014 per pound of C.O.D.
$.030 per pound of S.S.

Annual Industrial Cost Recovery Rates

Current ICR rates reflect only a portion (approximately 1/3 of the total) of the federally funded system completed and in use.

Flow	$.017 per 1000 gal
C.O.D.	.001 per pound
S.S.	.001 per pound

Total cost to upgrade/expand
$349,333,000

Metropolitan Waste Control Commission (MWCC) was selected as a case study because it is a large regional system. MWCC was created in 1969 to serve a seven country metropolitan area of 3000 square miles containing approximately 100 communities.

MWCC designed and installed approved user charge (UC) and industrial cost recovery (ICR) systems. MWCC meters the flow from each community and bills each community for its proportionate share of operation and maintenance costs and debt service costs. If the community is one of the approximately 35 with industries subject to surcharge, MWCC calculated the surcharge. MWCC bills the industries directly in approximately 30 communities. The remaining 5 communities bill their own industries. MWCC bills each community for the normal volume charges (residential and commercial customers) and the communities bill each of their normal volume charge customers.

MWCC illustrates the successful development of a regional wastewater treatment facility for a large number (33) of the independent treatment facilities serving 100 separate communities.

Village of Fredonia
Village Hall
Fredonia, NY 14063

Design Capacity	3,300,000	gpd
	9,900	lbs/day B.O.D.
	5,600	lbs/day S.S.

75% of design capacity presently utilized

A combination of secondary and tertiary treatment levels, utilizing an activated sludge process (including nitrification) will result from the EPA grant

User Charge Rates

$1.00/1000 gal flow

Village expects to develop a surcharge for industrial customers once measurement of their input is completed.

Annual Industrial Cost Recovery Rates

Flow	$11.57 per 1000 GPD - peak flow
Flow	$15.17 per 1000 GPD - average daily flow
B.O.D.	$ 2.53 per average daily pound
S.S.	$ 6.95 per average daily pound
Phosphorus	$97.36 per average daily pound

Total cost to upgrade/expand

$13,800,000

Fredonia was selected as a case study because -

- It is a relatively small city and POTW
- It has seasonal food processing industries
- It has effectively installed ICR.

Fredonia is an example of a small community where a local official (village attorney) was able to study the appropriate EPA regulations and design and install an approved ICR System. For the three industries in the village, no additional cost were estimated to design, implement, operate and monitor the ICR System. Annual ICR payments are estimated at $30,000 - an example of ICR cost effectiveness.

The three industries in Fredonia have been involved and informed about ICR. While all do object to paying additional costs such as ICR, all have so far remained within the POTW. The Village, however, is concerned that the additional ICR charges may cause the industries to move or go to self treatment, to the detriment of the Village and the residential customers. The Village objects to the restrictions imposed in developing user charge and ICR systems and the resulting effect upon industries served by the POTW.

Village of Greenport
236 Third Street
Greenport, NY 11944

Design Capacity	500,000	gpd
	833	lbs/day B.O.D.
	917	lbs/day S.S.

Present treatment facility will be utilized at approximatly 70% of design capacity once the two industries meet their pretreatment requirements.

Secondary treatment levels utilizing primary sedimentation, aerated lagoons, final settling and chlorination results from the EPA grant.

User Charge Rates

$.86/1000 gallons

Annual ICR Rates

Flow	$28.91 per 1000 GPD
B.O.D.	$ 3.57 per average daily pound
S.S.	$ 1.63 per average daily pound

Total cost to upgrade/expand

$879,000

Greenport was selected as a case study in order to illustrate the impact of ICR requirements on a very small facility. Greenport has two "industries" with the following characteristics:

A - 50,000 GPD
500 lbs/day B.O.D. - prior to pretreatment
417 lbs/day S.S. - prior to pretreatment
83 lbs/day B.O.D. - after pretreatment
79 lbs/day S.S. - after pretreatment

B - 10,000 GPD
167 lbs/day B.O.D. - prior to pretreatment
167 lbs/day S.S. - prior to pretreatment
16 lbs/day B.O.D. - after pretreatment
31 lbs/day S.S. - after pretreatment

With these characteristica and alternative definitions of industry, there may be one or two "industries":

- under the SIC definition, two industries
- under 25,000 GPD and no pretreatment, two industries.
- under 25,000 GPD and pretreatment, one industry.
- under SIC definition and 25,000 GPD and no pretreatment, two industries
- under SIC definition and 25,000 GPD and pretreatment, one industry.

With either one or two industries, Greenport was required to design and implement an ICR system. Depending upon pretreatment or not, the following ICR collections per year are possible:

- With no pretreatment $5064 per year.
- with pretreatment (1 industry) $1870 per year.

Greenport illustrates the burden of maintaining an ICR system for a small facility with limited industries. Under current definitions, Greenport will receive $187 per year (10% of $1870) for administering an ICR system and will reserve $748 per year (40% of $1870) for future facility requirements.

Bureau of Water Pollution Control
40 Worth Street
New York City, NY 100013

Design Capacity 1,800,000,000 gpd
estimated if all facilities are completed.

Present treatment facilities provide secondary level of treatment. With upgrading, advanced secondary will be the general level of treatment.

User Charge Rates

The City does not have an approved user charge (UC) system. The City does have a sewer rental surcharge for those industries whose wastewater exceeds 300 mg/l for B.O.D. and/or S.S. The surcharge varies by the wastewater characteristics of specific industries. The surcharge was not, however, based upon projected operation and maintenance costs.

Annual Industrial Cost Recovery Rates

No ICR system or projected ICR rates have been developed.

Total cost to upgrade/expand

$3,000,000,000 estimated if all facilities are completed.

New York City was selected as a case study for the following reasons:

- Large investment in upgrading/expansion.
- Effort required to comply with the appropriate user charge (UC) and industrial cost recovery (ICR) requirements.

Outlined below are the issues and observations resulting from our data collection visit to the City on 8/10/78.

- Only 6 of the 14 drainage areas have been funded by 92-500 monies. Therefore, a decision as to system wide or specific drainage area ICR system must be made. The question of rate inequities from one drainage area to another or potential law suits must be answered before initiating the design of an ICR system.
- Analyses to identify all industries in the city must be made. The current strength of wastewater now subject to surcharge exceeds "normal domestic waste". Those industries exceeding "normal domestic waste" in strength but less than 300 mg/l must be identified.
- Financial reporting systems must be reviewed to determine whether or not appropriate financial data to develop user charges is available for setting rates.
- Development of a computerized data base for customer billing and collections will be necessary because of the potential volume of activities.

Because of the size and complexity of the project, it is very unlikely that the City can complete the design of user charge and industrial cost recovery systems by June 30, 1979.

City of Plattsburgh
City Hall
Plattsburgh, NY 12901

Design Capacity	16,000,000	gpd
	45,000	lbs/day B.O.D.
	32,500	lbs/day S.S.

73% of design capacity presently used

Secondary treatment level utilizing an activated sludge process (including nitrification) results from the EPA grant

User Charge Rates

Three major industries pay on the basis of measured waste flow

OM&R -	Flow	$83.68/million gal.
	B.O.D.	$.025/lb.
	S.S.	$.027/lb.

Local capital costs are paid proportionately over a 30 year period by the three major industries. Remaining customers pay declining block rates from $1.4625/1000 gallons for the first 9000 gallons per quarter to $.3938/1000 gallons for usage over 501,000 gallons per quarter.

Annual Industrial Cost Recovery Rates

Not applicable since EPA grant was under PL 84-660 and not PL 92-500.

Total cost to upgrade/expand

$12,790,000

The city of Plattsburgh was selected as a case study to illustrate successful cooperation between local government and the major industries in the city utilizing the publicly owned treatment works (POTW). In 1971, the city and the three major industries (Diamond National Corp., Georgia-Pacific Corp. and Imperial Paper Co.) entered into a written contract whereby -

- the city would design, construct, operate and maintain a POTW.
- the city would accept and treat all wastewater from the three industries so as to meet all standards for pollution abatement.
- each industry would pay its proportionate share (based on usage of the POTW) of the total annual capital cost over the life of the project.
- each industry would pay its proportionate share (based on usage of the POTW) of total annual operating and maintenance cost.
- a board consisting of representatives from each of the three industries, the State University of New York and the City would be established to review operation and maintenance costs and procedures and cost allocations.

During our grantee data collection visit in the City on 7/31/78, we met with City POTW officials and with representatives of the three industries. There appeared to be a cooperative attitude from all involved. The monthly meetings of the review board appear to be successful in controlling operating costs and maintaining the spirit of cooperation.

A potential problem for the City and the three industries is the effect of pending pre-treatment standards for the paper industry and the potential reduction of usage of the POTW by the three industries.

City of Woonsocket, Rhode Island
City Hall
169 Main Street
Wonsocket, RI

Design Capacity	16,000,000	gpd
	33,400	lbs/day B.O.D.
	40,000	lbs/day S.S.

50% of design capacity presently utilized (outlying municipalities have not been connected). Secondary treatment level utilizing an activiated sludge process (no nitrification) will result from the EPA grant.

User Charge Rates

$.21/1000 gal flow
$.037 per pound of B.O.D. in excess of 250 milligrams/liter
$.05 per pound of S.S in excess of 300 milligrams/liter.

Annual Industrial Cost Recovery Rate

Flow	$17.50 per 100 GPD
B.O.D	$ 3.20 per average daily pound
S.S.	$ 3.06 per average dialy pound

Total cost to upgrade/expand

$23,661,000

Woonsocket was selected as a case study for the following reasons:

- industrialized city in north east
- Significant textile industry in area
- Local industry appears to be only marginally profitable and the imposition of ICR may have a significant impact.
- Cooperation between local government and industry in opposition to ICR.

During the course of the C&L project, Woonsocket officials demonstrated the local opposition to ICR. Illustrations of the opposition included the following:

- When the C&L consultant visited Woonsocket on August 9, 1978, to collect the grantee information, the City Scheduled a public meeting so that local industries could express their opposition to ICR. Over thirty people attended the meeting. The local newspaper carried an article, with a picture, of the meeting.
- A copy of the "Hon. John A. Cummings, Mayor, Woonsocket, Rhode Island, Statement Before the Senate Public Works Committee, Washington, DC on Tuesday, June 18, 1974 was furnished to express the City's position opposing ICR.
- Attendance at the ICR Regional Meeting in Boston on October 24 by representatives of the City, local industries and industrial associations to present prepared statements opposing ICR.
- Attendance of Congressional staff members at the 8/9/78 Woonsocket meeting and the 10/24/78 Boston meeting.

The Woonsocket activities illustrate a coordinated effort to present a wide range of support for a specific issue - oppositon to ICR.

Woonsocket is an area where the local economy may be impacted by the imposition of user charge (UC) and industrial cost recovery (ICR) rates. A more detailed economic analyis of the impact of UC and ICR on the local economy should be conducted.

IV. DETAILED CONCLUSION

Based on previous discussion and comments received concerning the various alternatives to ICR, the Environmental Protection Agency presents a conclusion with regard to Industrial Cost Recovery as it is presently constituted, and also identifies these related issues which may require further study. The conclusion is as follows:

THE INDUSTRIAL COST RECOVERY PROVISIONS OF P.L. 92-500 HAVE NOT ACCOMPLISHED THEIR LEGISLATIVE PURPOSES

ICR is not meeting the legislative and economic intent which led to the enactment of ICR:

- Changes in tax law and IRS regulations since 1972 have impaired the ability of (or need for) ICR to serve as an equalizer in sewage treatment costs. For medium or large discharges of compatible wastes, it appears less expensive over time to build and operate their own self-treatment facilities than it is to pay a proportionate share of the operating costs and local debt service of a public sewage treatment system.

- ICR has not served to control design and construction of excessive future capacity in wastewater treatment facilities. The average useage in the 227 facilities surveyed was 68% of the design capacity.

- ICR is not credited with a role in encouraging water conservation. The industrial plants responding to the Coopers & Lybrnad syrvey reported an average reduction in water use of 29% (which could have an impact on the amount of future capacity that should be built), but attributed the reduction to increased water rates and sewer user fees rather than ICR. ICR is a relatively small charge to industry when compared with sewer user fees and water rates (ICR on the average is equal to about 10-15% of total sewage costs).

- ICR is inherently cumbersome to administer, and it does not seem probable that it can be further improved or modified without eliminating its original intent.

ICR is also found to have the following undesirable effects:

- It is a set of burdensome, complex Federal Law and regulations that are only marginally cost effective, when comparing the administrative costs of ICR to the ICR revenues collected.
- It increases total sewage costs to industry.
- It creates discrimination in sewage costs, both with regard to type of business and size of business charged.

On the other hand, ICR also has the following positive effect:

- ICR will generate revenues to grantees and the U. S. Treasury. Total ICR revenues over 30 years are estimated to be between \$1 and \$2 billion. A few municipalities have already included their portion of the anticipated ICR revenue as income in their operating budget plans.

As mentioned earlier, however, there were several reasons for originally requiring ICR: parity, proper facility sizing, promoting water conservation, and self sufficiency. Central to the entire focus of P.L. 92-500 was the elimination of multiple wastewater discharges through regionalization of treatment facilities and encouraging industries to participate in publicly owned treatment works. The Legislative History summarizes the Congressional intent as follows:

> The committee devoted a great deal of attention to the difficult issue posed by the discharge of industrial pollutants into publicly owned treatment systems. There is much to be said for encouraging industrial use of public facilities. Each industrial discharge into a public system is one less outfall that must be monitored, and in many cases the economies of scale that

> characterize public treatment works would permit a net capital saving to the economy as a whole, assuming that the alternative to industrial use of public facilities is the on-site treatment by industry of its own wastes.
>
> The bill would deal with industrial pollutants in this way: each industrial user of a public system would pay a charge that would include not only that share of operating and maintenance costs allocable to such user but which would also be sufficient to recover that portion of the Federal share of the capital cost of the facility allocable to such user. That portion of the Federal share of the capital cost allocable to each industrial user would be returned to the federal treasury.
>
> The committee believes that this approach to the issue of industrial use of public facilities appeared to the committee to be the most reasonable and equitable one that can be devised. Any scheme that did not provide for full recovery of the Federal share of capital costs allocable to industrial users would clearly constitute a Federal subsidy of private industry and, more particularly, of those industries that were so situated as to make use of public facilities and industries producing wastes that are compatible with public treatment systems. Any other approaches would discriminate unfairly against those industries which, for whatever reason, were unable to utilize public systems.

The Conference Committee also recognized some of the potential conflicts that ICR represented, as the following passages discuss:

> It may be that the Congress will, at some future time, determine that some form of Federal financial assistance to industry in meeting pollution control costs -- whether through tax relief, loans, or grants -- is appropriate. The committee does not prejudge the propriety or need for such assistance. But the committee does conclude that subsidy of private industry through the waste treatment works grant program would be haphazard and inappropriate. . .
>
> It may prove to be the case in certain instances that individual industrial operations will conclude that it will be more economical to treat their own wastes than to discharge into a public system. If and where such instances arise, it is logical to conclude that a net saving to the taxpayer and to the consumer will result. It is certainly not the intent of the committee

> to discourage industrial use of public systems. It is the judgement of the committee that the industrial "pay-back" requirement will not discourage such use in most cases. It is clear that the environmental costs should be borne by those who place demands on the environment. User charges carry out this principle.

As discussed earlier, tax incentives and accelerated depreciation now make it attractive for many industries to self-treat rather than to discharge to a POTW. With the added cost of ICR the economic advantage of self-treatment is exagerated even greater. Unfortunately, it appears that a net saving will not result in those cases where industries chose to withdraw from a POTW after the treatment works have been constructed (see the Sacramento Case Study, Chapter III-6). In the case of Sacramento, the treatment works was sized and constructed to accomodate waste discharges from industrial users. Two large industries now find that current cost estimates, including ICR, substantially exceed the costs of self-treatment, and the industries are seriously considering withdrawing from the POTW. If these industries withdraw, the remaining users will be faced with an estimated 11% increase in monthly sewage charges. Once a plant is constructed to handle a specific discharge, decreased flows and loads to the treatment works do not necessarily mean decreased operating costs, because a large portion of the total operating costs of a POTW are fixed costs rather than variable costs. Costs in a POTW generally do not decrease in direct proportion to decreased loading.

During the course of the study, several other issues were identified relative to the other aspects of ICR's intent (treatment capacity and water conservation) and the total cost of sewage treatment. These issues may require further study, in light of the passage of the Clean Water Act of 1977 (P.L. 95-217) and its implementing Regulations. These issues identified were briefly discussed as follows:

ISSUE #1

> Change the criteria for determining the amount of capacity eligible for federal grant support, to eliminate federal support for speculative industrial capacity.

The basic idea contained in this issue is to address the proper sizing of treatment facilities. Proper sizing begins with the planning process and, if it is to be successful, must include information from all user classes, including industry. Proper sizing also places a burden on the planning agency to provide detailed, accurate, and up-to-date cost estimates to interested parties, including industry, in order to allow all parties to make intelligent, well-considered decisions concerning the size of the POTW and who will participate in the POTW.

Redefining grant eligible costs to include "immediate" needs only should tend to force both potential grantees and EPA to reduce excess future capacity. Please note that "excess capacity" is not used in a pejorative sense. The point has been made that capacity created at today's costs will often be cheaper than capacity created at future costs. The point to remember, and the reason this issue is presented, is that excess future capacity sometimes puts an excessively heavy economic burden on current users. In essence, current users pay inflated O&M and debt service costs in order to provide capacity for future users. In addition, in the past, the Federal Government, through EPA construction grants, has borne 75% of the construction costs of this excess capacity.

"Immediate capacity needs" are defined to be treatment capacity to meet national discharge standards of secondary treatment in most locations, unless EPA specifically determines (on a case-by-case basis) that AWT is required. If a state or locality chooses to build an AWT facility, EPA's grant would be limited to 75% of the eligible costs of secondary treatment facilities, unless EPA determines AWT to be necessary. This puts the burden of the incremental costs of AWT on the states and localities which opt for it. Immediate capacity needs would also be defined to include: (a) existing industrial capacity; (b) future industrial capacity for which contractually binding letters of commitment had been negotiated between the grantee and industrial user, and (c) existing and projected residential and commercial capacity. This should encourage more precise planning of facilities, since grantees will be required to improve the quality of their facility sizing estimates. Particular attention should be called to the 29% water conservation to date reported by industries surveyed during the study. This trend, if it continues will reduce the future capacity needs of grantees designing wastewater treatment facilities.

The major difference between the current cost-effectiveness guidelines and the redefined grant eligible costs is that there would be no allowance for speculative future industrial capacity. The only industrial capacity that would be funded would be current industrial capacity, and capacity for which industry has signed a binding contractual agreement. As noted earlier, this places a burden on industry to define future wastewater discharges. It also places a burden on grantees to produce accurate estimates of costs because industry will be less likely to place unbridled faith in grantee's cost estimates if these estimates must be relied on to provide the decision-making base for a long term contractual commitment.

All parties will become more actively concerned with proper sizing. Treatment capacity in excess of immediate needs for residential, commercial and industrial users would reduce total grant funding as grantees designed treatment works larger than immediate needs indicate, and more sophisticated than required by secondary treatment. The more the proposed plant exceeds current needs, the larger the grantee's local share will become. In addition, the grantee's local share will become proportionately larger. EPA's percentage share of eligible project costs would decrease, from 75% to 70%, 65% or less depending upon the type and size project proposed by the grantee. If consistently followed, this procedure should provide positive economic incentives for all classes of users to become actively involved in planning and sizing new wastewater treatment facilities.

ISSUE #2

Require repayment of local debt service on a proportional basis.

The intention is to encourage water conservation and better better facility planning, require a more uniform approach to computing rates, and eliminate wastewater debt service as a demand on local property tax revenues.

Survey data indicates that requiring that local debt service be included as a proportionate component of the rate base will not be a drastic or even substantive change for the majority of grantees. Of those interviewed, approximately 70% currently include local debt service in the user charge rate base. The remaining grantees use a variety of methods to recover funds to be applied to retirement of debt associated with the wastewater treatment works. Some of the more common methods are as follows:

- Ad valorem property tax.
- Front-foot benefit assessments.
- Flat rate charge per user.
- Connection fee.
- Declining block rate (the higher the flow to the treatment works the lower the unit charge for service becomes.)

None of these charges are designed to promote water conservation or achieve parity in rate setting based on use. Also, all of the methods, except for the connection fee, require current users to bear the burden of excess capacity costs for future users. These rate methods also tend to favor the large user at the expense of the small user, because often the size or value or number of pieces of property in a community do not correlate well with the amount of service required from the POTW and the debt service charge levied.

Making debt service a proportionate part of the user charge should encourage water conservation and better facility planning - the larger the wastewater discharge the larger a user's bill will be. Some of the methods currently in use do little to promote water conservation because the amount charged the user does not relate to the amount of wastewater discharged to the POTW. Paying annual debt service through a property tax mechanism is almost a hidden charge, highly visible when paid but difficult to relate to an actual service performed.

Requiring debt service to be paid as a proportionate part of the user charge would shift the economic burden from a property based charge to a charge based on use. This would free property tax revenues to be used to fund other essential services that are not as readily adaptable to a usage based charge system.

Another major advantage of this method is to make rate setting methodologies more uniform on a national basis. Actual rates charged will still vary depending upon the size and type of treatment works. However, all grantees will have to include the same major components (O.M.R. and debt service) in the rate base. Including debt service would ensure that those placing demands on the environment would actually pay the total cost of treatment. Grantees would no longer be able to offer discount rates to certain users by excluding capital costs from the ratemaking formula. This would reduce any geographic disparity that may exist in parts of the country. For instance, while not actually required by the state, California, strongly encourages grantees to include debt service in the user charge. In effect, industries in California face an economic disadvantage compared to other areas that do not require that debt service be included in the user charge.

ISSUE #3

Require each grantee to establish a locally administered trust fund for reconstruction or expansion of the treatment works, charging a uniform national rate to all users.

This issue (self sufficiency) deals with the following: (a) Establishment of a uniform national charge for ultimate reconstruction of the wastewater treatment facilities; (b) Reduction in future demands for federal grants for reconstruction; (c) Creation of a fund for reconstruction which will serve to assure the availability of reconstruction funds when needed, eliminating some of the financial problems presently surfacing in other federally-supported construction projects, such as the Interstate Highway System, and (d) Replacement of the share of ICR currently retained for use by the grantee.

In order to insure self sufficiency each grantee would establish and administer his own trust fund, and would publish an audited financial report annually, similar to existing Revenue Sharing requirements. The reconstruction and expansion trust fund would not replace the reserve for major recurring repairs comprising the replacement portion of existing User Charge system. The trust fund may or may not generate 100% of reconstruction and expansion costs (depending on local conditions and specific circumstance), but would certainly reduce demands for capital financing when reconstruction occured. The trust fund assets would be invested in federally secured obligations until expended. It is estimated that a uniform charge of $.02 per thousand gallons, if invested and compounded annually , would generate approximately $20 to $30 billion over 30 years. A proxy for this charge could be developed for those grantees who qualify for and elect to use ad valorem taxes as a partial substitute for User Charges.

The estimate of the amount of revenues generated are based on the following assumptions:

- Average population during the 30-year period will be approximately 240,000,000 people.
- A 120 gallon per capita per day discharge approximately equals residential and commercial discharge during that period.
- Industrial discharge represents approximately 15% of the residential/commercial discharge.
- Funds generated annually from the $.02 per thousand gallon charge to all users will be compounded annually at 7.2% for 30 years (which seems appropriate based on today's interest rates).

Total revenue generated under these assumption, will be almost $24 billion. Given the uncertainty associated with some of the assumptions, a reasonable estimate would place total revenue generated between $20 and $30 billion.

The major advantages of this type of charge are that the charge would create a non-disriminatory, uniform, national charge for all users, to be used to replace the treatment works, thus reducing the need for Federal grants in the future. Such a system would be easy to administer and monitor and would require no additional administrative apparatus on the grantee's part. It would also ensure that funds are available at the local level to replace the ICR funds eliminated with Recommendation #1.

Summary

In summary, the study's Conclusion recognizes that social and economic objectives of ICR are valid. However, ICR in its current form does not fulfill these goals and ICR should be replaced with other mechanisms more likely to accomplish the original purposes of ICR. Issue #1 deals with a limit on the size and sophistication of treatment works to be funded with EPA construction grants, reducing EPA participation as the plant grows larger and more technically complicated than immediate needs dictate. Increasing the local share of project costs and requiring industries to enter into binding contractual agreements to pay for future, reserved capacity should cause all parties to pay serious attention to the sizing and design criteria of the treatment works. It will also require that the bulk of the costs of future capacity be borne by future users rather than current users.

Issues #2 and #3 address the uniformity of rate setting methodologies, striving for administratively simple solutions to the problem of arriving at national rates. The purpose here is to ensure that all users pay their equitable share for the burdens placed on the environment and for replacing the wastewater treatment facilities necessary to protect the environment.